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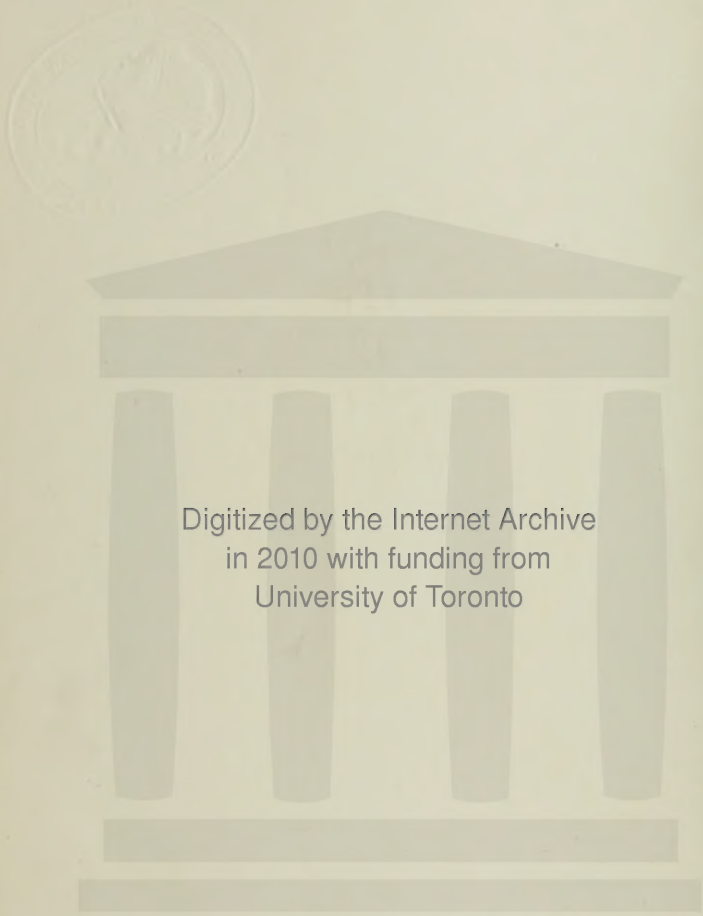
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JOURNAL

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THE ROYAL SANITARY INSTITUTE

DISCUSSION ON MODERN METHODS OF SEWAGE DISPOSAL,

With Special Reference to the Elimination of Suspended Matters.

Opened by G. A. HART,

Sewerage Engineer, Leeds,

(MEMBER.)

At Sessional Meeting, Leeds, November 29th, 1907.

THERE are some important features which at the present time are exercising the minds of those specially interested in the development of sewage purification, and which it will be interesting to discuss.

Those who are familiar with the practical difficulties which surround the application of the theory of sewage disposal, and which confront many of the public authorities throughout the country, more especially in our industrial populous centres, cannot fail to have observed that the problem of the prevention of pollution to our streams and water-courses must of necessity be developed slowly, and it is especially interesting to observe the limitations which physical environment have in determining the form of treatment which various authorities find it most expedient to adopt. The experience of the past has shown how unwise it is to generalize in too comprehensive a manner on questions of sewage treatment, and we have now attained the stage in development when it is universally recognised that it is futile to attempt to lay down laws in sewage treatment as being generally applicable to the varying conditions of different localities.

I believe it may truly be urged that, out of the maze of controversy which has in the past surrounded the question of sewage treatment, we may hope to be in a position to regard this question as an equation in

which the financial or business factor will take an equally important part and run collateral with the scientific and physical factors, and from which it will be practicable to produce, with the assistance of the data we have compiled, the most expedient solution to any particular problem.

The obligation which is imposed upon our large inland authorities of purifying the sewage and storm-water which proceed from their areas before passing into the rivers, is of such a formidable character that it is by no means clear that those authorities will ever be able on the present basis to fulfil the task imposed upon them. With the advantages of present day knowledge, and with the support of our communities and authorities, we may now claim that there is evidence that it is practicable to prevent pollution from sewage and storm-water as far as a given point in the scale of purification; and in this respect there appears to be also some evidence that the day is coming when some regard will not only require to be paid to the quality of an effluent, but that some standard in which quality and quantity in due relation, both to effluent and the stream into which the same effluent is discharged, will be indissolubly connected, and that consideration will be given to the character of the stream into which effluents are discharged.

With a few notable exceptions there was little to be observed except the progress of continued failure in sewage treatment before the function of bacteria in relation to the decomposition of organic compounds was discovered.

The progress of the last fifteen years in the practical application of bacterial life to sewage purification, has now effectively demonstrated that these organisms can be utilised to higher advantage under certain artificial and more or less controllable conditions than is practicable in soil of variable constitution, and it is also true that there is great difference of opinion at the present day amongst skilled experts upon the more or less important questions of detail which govern the form of treatment which should be given to sewage in order that bacteria may exercise their functions to the highest advantage, and this is equally true of the engineering side of this problem, and one may venture to say that it is equally true of any other involved problem having unstable conditions to deal with. It has been, however, now fully demonstrated that the essentialities of the problem may be attained within the bounds of practice by different methods which fortunately have afforded and continue to afford scope for resource and ingenuity, and which will no doubt continue to be developed to higher degrees of refinement.

The success of the artificial processes of bacterial treatment may now be said to have withstood the onslaught of doubt and suspicion which was inevitable, so that we may claim that the fundamental principles of sewage purification are firmly established. In this respect, all are waiting with expectancy the issue of a further report of the Royal Commission on Sewage Disposal, in the hope that the benefits of their laborious and prolonged investigations may go far to establish the justification of the efforts which have been made by authorities to carry out their responsibilities, in view of the knowledge they had at their disposal.

The consolidation of bacterial processes has gone far to demonstrate the practicability of producing effluents which are at least non-putrescible within reasonably defined limits of volume, but the satisfactory purification of storm-water may be said at this stage to remain unsolved, and it is to this question I believe that the minds of those specially engaged in the study of sewage purification will require to give special consideration in the immediate future.

Special filters constructed with a view to the extraction of solid matter by straining through medium as a purely physical operation have not proved reasonably successful, and we look to-day to some more satisfactory and practicable method of accomplishing this object being attained.

The most important features round which controversy is raging relating to the construction of bacteria-beds are undoubtedly those of (1) the nature and size of medium to be employed, and (2) the method of distribution to be adopted upon the bacteria-beds.

The experience of Salford and Birmingham with fixed distributors, and the investigation which Mr. J. D. Watson, the Engineer to the Birmingham Tame and Rea District Drainage Board, has conducted, with movable circular and fine distributors, and those of Messrs. Willcox and Raikes at the Hanley Sewage Works with movable rectangular distributors, are worthy of careful study.

Research into this question would appear to show that given suitable conditions, the fixed sewage distributor more than justifies its existence when judged by the practical results obtained in the effluents produced by those bacteria-beds, and it is difficult to explain why the defects of this method of distribution, in respect of inequality of distribution over a given area, do not bring about a corresponding result in the bed effluent, which theory would lead one to believe must inevitably occur. There are obviously compensating advantages which neutralise the effect of this deficiency and which remain undetermined.

Many investigations have been conducted with a view to ascertaining what is the most suitable size of medium to adopt for bacteria-beds constructed on the percolation principle, and to some extent it would appear that this problem is not merely confined to the simple issue of ascertaining what are the limits to which the size of material should be graded for the purpose of allowing suspended matter to pass down freely through the bed between the interstices of the stones, and at the same time present the maximum surface area of medium to the fluid as well as to allow the requisite quantity of air to regularly and evenly pass through the bed with the liquid, and by which a continuous process may be operated. The problem is undoubtedly complicated by some physical action which takes place in the bed, and which appears to be the result of the action produced by friction of some of the constituents of the fluid upon the medium itself.

The elimination of suspended matter from sewage and its ultimate satisfactory disposal with advantage still remains to-day the most important problem, presenting the greatest difficulty, which those connected with sewage disposal have to meet. This difficulty very largely centres in the circumstance that the difficulties in sludge disposal of large and small communities are not strictly comparable. Indeed, there are notable instances in which the facilities of inland navigation, by means of which it has been rendered practicable to remove out to sea the whole of the solids which some of our largest authorities produce at their outfall works, has been a most fortuitous circumstance, and one upon which those authorities have reason to be congratulated.

It has now been demonstrated that any hopes we may have raised can no longer be entertained in the expectation that septic fermentation of sewage would finally solve the problem of how to eliminate and dispose of solid matter contained in sewage: but it has also been demonstrated very forcibly that, under certain conditions, this form of treatment has proved eminently successful, and in this respect one of the most noticeable features has been the odourless condition of the septic residual sludge deposited in the tanks, and the facility with which this residual sludge is air-dried in porous ground without any anxiety arising upon consequential nuisance during the process. On the other hand, one cannot disregard with prudence the evidence that, under certain conditions, septic treatment may, in its initial stage, become obnoxious.

The evidence of the degree of digestion of solid matter in the septic tank is very variable, as one would naturally expect with such an unstable

or varied mixture as crude sewage, but it is to be noted that septic tank effluents invariably contain relatively high proportions of suspended solid matter, which still require to be eliminated as a further process before disposal may be regarded as complete.

It has not yet been demonstrated that it is practicable to produce effluents from bacteria-beds which shall be free from suspended matter, and it is a subject of keen controversy as to how far one is justified within the limits of practice to carry the refinements of the elimination of solid matter from tank effluents before the effluents are applied to bacteria-beds. In this respect it is not out of place to direct attention to the advantages to be gained by chemical precipitation of crude sewage, which in the case of the Leeds experiments demonstrated how rapidly a thoroughly clarified effluent, produced by chemical precipitation, can be oxidised, and what a comparatively small amount of suspended matter remained in the effluent. It is true that the suspended matter contained in the effluents coming from bacteria-beds treating septic liquor and precipitated sewage was generally a non-putrescible compound, and this could not also be said of the suspended matter contained in the effluents produced by those bacteria-beds treating settled crude sewage; but it is questionable how far one may correctly regard the suspended matter which is contained in these effluents as having been disposed of if they are present in these effluents in a well oxidised and non-putrescible form.

The separator tank which Mr. Watson, the Engineer to the Birmingham Tame and Rea Drainage Board, has designed for the express purpose of removing this suspended matter from his bacteria-bed effluents has, I believe, been highly successful upon an extensive scale; so that if one is provided with satisfactory means of air-drying this material, as, say, by the use of open and porous land, we may reasonably hope that this difficulty may be eventually overcome in a great many cases. There are, however, a great many instances of authorities in this country who have not been provided with the natural means of reducing to solid and controllable form suspended matter which is contained in sewage sludge, and in such instances there is much to be said in favour of the system of treatment which provides for as complete clarification of the sewage as practicable in its initial stages of treatment.

Judging from the present condition of our rivers in most industrial centres, it is probable that those effluents whose only defect might be that they contained a relatively high proportion of non-putrescible suspended matter may be regarded somewhat sympathetically. It can, however,

be scarcely questioned that authorities will not be permitted to use this process as a method for the disposal of solid matter; and should the standard which authorities are required to comply with contain a definite factor in this respect, it will be interesting to see how far the influence of the imposition of that condition may go in directing attention to the importance of eliminating suspended matter from sewage at the earliest practicable stages in its treatment.

Dr. Wainman (Vice-Chairman, Sanitary Committee, Leeds) welcomed the members.

Mr. E. J. Silcock (Westminster and Leeds) said he wished to draw their attention to the particular time during the process of purification at which the separation of the solid matter should take place. This involved the question as to whether or not it was necessary for anaërobic action to go on in sewage before applying to it a process in which the circumstances were favourable to the aërobic organisms. It was at one time held by many as an axiom that it was necessary to have a distinct anaërobic step in any system of purification. It was not clear when anaërobic action first started, but it probably commenced immediately the sewage entered the sewers, and it might depend to a certain extent on the length of sewers, and therefore on the time occupied by the sewage in reaching the disposal works, whether or not the anaërobic process, if essential, was sufficiently advanced to obviate the necessity of providing tanks in which that action could take place. The experiments carried out at Leeds in connection with what was known as the Leeds bed, to which screened fresh sewage was applied, indicated that (at all events, in the case of sewage remaining in the sewers as long as the Leeds sewage) it was possible to obtain by aërobic processes alone a satisfactory degree of purification. In the numerous cases of contact beds dealing with crude sewage, of which the Sutton installation was the earliest, good results in purification, apart from the choking of the beds, had been attained by applying fresh sewage to an oxydising process. Therefore, if apparatus can be devised by which the solid matter can be passed through the oxidising bed, it would appear that there is no reason why the separation of the solids should not be effected after the liquid had undergone the oxidising process. The solids so treated would be in a non-putrescible state, and their removal from the liquid portion of the sewage could be easily effected by settlement in tanks or lagoons, application to land, or sand filtration. The sludge produced by any of these processes would dry more rapidly and, being non-putrescible, would be more easy to deal with than the

sludge produced by any system prior to the oxidising part of the process. If, therefore, the suspended matter could be eliminated at the later stage, a very solid advantage would be obtained.

The next point to be considered was the total amount of solid matter which could be eliminated by the varying processes. There were practically three methods of separating solids prior to oxidation, namely, chemical precipitation, natural settlement, and septic tanks. Judging by the experience which had been obtained with Leeds sewage, the quantities of sludge produced by those three processes were in the ratio of three, two, and one. So far as he was aware there was no information as to the quantity of sludge to be dealt with when the solids were separated after the oxidising process, but they would probably be less than with a septic tank. If one had no facilities for getting rid of the sludge it proved a very great difficulty, and obviously a system which tended to reduce the total quantity would receive favourable consideration. Where, on the other hand, sludge could be shipped out to sea or could be otherwise readily disposed of, it might be an advantage to remove the sludge as soon and to the greatest extent possible, and therefore to have less to deal with at the latter stages of the purification process. It was thought years ago that the sludge from septic tanks would be very offensive and cause grave nuisance, but he thought more recent experience had disproved this, and it was now known that septic sludge could be handled without creating more nuisance than when dealing with ordinary sludge; and, apart from this, the drying of the sludge from a septic tank took place more quickly than was the case with chemically precipitated sludge.

The next question to which he directed attention was that of the size of the material to be used as the filtering medium for oxidising beds, and here again considerable difference of opinion existed. The case for small-grade medium had been very forcibly put forward by Dr. Reid, whose experiments at Hanley tended to shew that the greater part of the oxidising and nitrifying processes took place near the surface of the beds, and that deep beds were unnecessary. He would like to point out, however, that such a system involved a most thorough removal of suspended solids before the liquid was applied to the beds, and from his experience he was inclined to think that even when the best possible had been done in this direction the colloids would form a mucus on the surface of the bed and ponding of the surface would take place. On the other hand, the experiments carried out in Leeds, already referred to, had shown that it was desirable to make the interstices of the filter large enough to allow of the passage of the solids in suspension through the bed, instead of giving them a chance of being retained, and that indicated that the material should be of as large a size as possible consistent with obtaining sufficient surface over which the liquid could percolate in contact with the bacteria.

How far this principle could be carried out would be determined in many cases by the fall available, which would regulate the depth of the beds, but

having been closely connected with the Leeds experiments, his views naturally tended towards a large-grade medium. He was of opinion that there was no half-way house between the two extremes, and that the material must be either very large or very small, or it might be that a thin layer of fine material on the surface of the bed (where it could be got at) would be permissible, the lower part of the bed being of large material.

Mr. J. Corbett (Salford) referred to the experiments carried out at Salford. They might take it as demonstrated that if they went to the expense of a sufficiently heavy dose of lime precipitate (a ton or a ton and a half to a million gallons) they could produce a clear liquid free from matter in suspension. Another very successful process was the filtration through fairly fine sand at high pressure. In both cases where he had the operation carried out the result was a perfectly bright liquid, which the chemists recorded as *nil* in regard to the matters in suspension. As to the more modern method of finishing the operation on bacteria beds, the point to consider was whether they should eliminate solid matter before reaching the beds or not. He contended the right time to eliminate was before the suspended matter was sent on to the beds, otherwise they would become more or less choked. Roughing filters of the general type now coming into considerable use for waterworks were equally applicable to sewage works. These filters were coming into use on the Continent and in America, and he had fitted up one at Salford. One result of that method of treatment would be a considerable reduction in the cost of chemicals, and the area of land required would also be much reduced. At Salford, when their works were completed, they would be treating the sewage of a quarter of a million population on an area of less than twenty acres. He believed that was a record, but it had to be noted that the Ship Canal enabled them to ship away any amount of solid matter at a cost of less than tenpence per ton. He hoped in time to have these roughing filters cleansed by a mechanical apparatus at a very moderate cost, and he wanted to cleanse them several times a day if necessary, a thing practically impossible by hand labour.

Dr. H. M. Wilson (Chief Inspector of the West Riding Rivers Board) said it was as yet an unsettled point as to whether suspended matter should be almost entirely removed from the sewage by tank treatment, or be allowed to go on to the filters. He agreed that an ordinary tank effluent could not be used on a filter bed of very fine material, because the suspended matter would be certain to choke up the bed. If a tank effluent was to be used on such a bed, it seemed necessary to resort to chemical precipitation. They would wait with interest to see what results Mr. Corbett got with the roughing filters; but, so far as he knew at present, no such process was adopted, and so far chemical precipitation

seemed necessary for a fine grade filter bed. By any other tank treatment the silting up of the filters and the trouble it caused must be faced. In Prussia they had set up the central authority so much asked for in this country, whose duty it was to advise sanitary authorities as to the best scheme of sewage disposal. Recently he saw a new set of sewage works adopted by a combination of four or five towns on the outskirts of Berlin, where this central authority had advised as to the best method. There they had, after great consideration, adopted coarse-grain filters, on which they were putting the tank effluent with its suspended matters. These were allowed to go through the filters; and it was believed that such filter beds could continue to be used almost indefinitely. It seemed to him that this method of dealing with the suspended matters was first suggested in Leeds by the experiments at Knostrop. He would like the opinion of members as to whether the suspended matter should be almost wholly dealt with in the settling tanks or be allowed to go on to the filters, and whether the filters should be of fine material, with the certainty of their requiring cleansing, or of coarse grain with the view of flushing the suspended matters through them.

Dr. Gilbert Fowler (consulting chemist to the Manchester Corporation Rivers Committee) remarked that the core of the sewage problem was really what was to be done with the solids. Already they had found considerable divergence of opinion, and that divergence, it seemed to him, must always exist while such differing conditions prevailed. Whenever visitors came to the Davyhulme works at Manchester, he always advised them afterwards to go to Salford, where the problem was dealt with under totally different circumstances. What was suitable for one works would be hardly suitable for another. In passing, he might say that they had experimented a good many years ago in Manchester with a mechanical roughing filter of the waterworks type, and found it very efficient, but expensive in their case, because pumping would have had to be resorted to. It might interest the meeting if he called attention to one point sometimes overlooked in discussing the agencies at work in getting rid of organic matter. He thought there had been some undue reaction of late caused by a certain amount of disappointment that sludge was still with us. In all these matters they should be careful before making broad statements. They forgot, he was afraid, that sewage was an extremely complex mixture, difficult to deal with in a scientifically exact manner. On the one hand, such a substance as urea was readily fermented to ammonia, even in passing through the sewers; on the other hand, cellulose was a matter that might take years to destroy, if ever it was destroyed. In between those two extremes were all sorts of differing substances, all requiring careful consideration. They had still a large amount of experimenting before them. The influence not only of bacteria, but of higher organisms, in dealing with suspended matters in sewage, was one of the questions before the Berlin

Congress, and he was quite sure they would hear more of it. He had found that the activity of worms had a great deal to do with the question; for when a sewage filter became water-logged, or if the mud from an aërobic filter was washed into a bottle or other receptacle, a great many of these worms came to the surface, showing that they required oxygen, and in its presence throve upon sewage matter. He had recently made some quantitative experiments with mud from a sewage filter, and found that on drawing air over it about 12 per cent. of the organic matter disappeared as CO_2 in twelve days, and some former results had been even more striking. Of course there were enormous quantities of bacteria also present: but besides these he felt convinced there were millions of worms at work, and so long as they were active there was little smell. He believed it was very largely due to these organisms that grease was eliminated from the solid matter in filter-beds, so that these solids could be rapidly dried without nuisance, the unpleasant smell of sludge being due, in his opinion, to the grease it contained. That was one of the difficulties that confronted them with the sludge from chemical treatment. If one had a steamer in which to convey the matter to sea the problem was not so great: but what was Mr. Hart going to do with all the sludge he would produce? He (the speaker) said he wished to emphasise the importance of all higher organisms in these filters as distinguished from bacteria; and he could not understand why it should still be stated to be essential that there should be a preliminary anaërobic treatment of the sewage. The simple fact that sewage, if continuously shaken with air in a bottle, would eventually be completely oxidised, was sufficient evidence on this point.

Mr. A. M. Fowler (Manchester) spoke of Leeds as his native town, and said that having been engaged on the construction of the Leeds sewers without intermission for a period of about twenty years, from the commencement of the works in 1851 up to 1872, he knew that none but sewers of egg-shaped form were constructed in Leeds, and they cost over a quarter of a million of money. But this country, although appreciating this scientific form of construction, had in the past and was now adopting the circular-shaped sewer: for no other reason than that they were easier to make.

The great cost of pressing the mud he had been able to avoid by constructing filter-beds, of special design, to the sewage works of Brighouse, where the mud was pumped into the beds; after a few days' treatment by this means only, it was dug up and carted away, with most satisfactory results. The beds had been in constant operation for about five years. There was no need for presses. The flow of the sewage was about 1¼ million gallons in twenty-four hours.

Although the trade of Leeds was varied, consisting of fellmongers, breweries, dyers, cloth dressers, chemical works, etc. (throwing off the very worst effluent from their establishments) yet the sewage was comparatively weak, therefore

all the more easily dealt with by the bacteria process. Leeds was also exceptional from the fact that a very large number of manufactories abut on two streams, tributaries of the River Aire, which streams flow through the town, and the waters are used over and over again; but from the fact of the Aire being navigable the waters thus used are returned to the stream highly polluted, the Aire and Calder navigation being protected against any abstraction of waters from the River Aire and its tributaries.

From the most recent experiments made at Devizes by Mr. Dibdin on the formation of bacteria-beds of slate arranged in layers, with two fillings per day after fourteen months' working the water content was found to decrease 50 per cent., but by flushing the beds the water content was increased to 82 per cent., the flocculent matter being very small and depreciable.

By the recent experiments at Trowbridge, by Mr. Charles J. Waterfall, it had been found that the power of various materials for use in bacteria beds was in the following order of efficiency, (sewage being 1·0), slate ·52, limestone ·47, broken brick ·35, slag ·32, clinker ·45. Slate here showed the best results, and brick was nearly as good as clinker.

The bacteria process was easily applied for small towns with excellent results: but for large towns, where manufacturing refuse had to be dealt with, great care had to be taken in preparing the sewage, either by subsidence, screening, or otherwise, before it was turned on to the beds for final treatment.

Mr. John D. Watson (Chief Engineer, Birmingham Tame and Rea District Drainage Board) said that to Leeds he personally owed a good deal. Sewage purification literature had benefited greatly by the contributions of Col. Harding, a former chairman of the Sanitary Committee of Leeds, and of Mr. Harrison, a former chemist. Speaking of the value of the Leeds experiments to engineers, he would like to say that they owed more to the work of Mr. Corbett than they had publicly acknowledged. It was fifteen years since Mr. Corbett began his experiments at Salford, and it had been proved by experience that the percolating beds he made many years ago were still amongst the most efficient. He was glad to hear the statement that roughing filters were about to be tried at Salford, and he had no doubt that they would be successful so far as working was concerned, but whether they would be an economical success or not was not so sure.

Mr. Watson thought it might be taken for granted that the objectionable features of sludge could be got rid of by the aid of the aerobic organism, but at what cost? He had demonstrated at Birmingham that the offensiveness of sludge could be got rid of by the aid of anaerobic organisms in a septic tank. Dr. McLean Wilson asked whether the solids in sewage should be dealt with before or after they had passed through the bacteria beds. The answer he would give would be that both should be done. One must get rid of these at

the earliest possible stage, first by arresting road detritus and heavy substances (both organic and inorganic) in what is known as the detritus chamber. Then he thought the sewage should be passed through a septic tank, where a good deal of the organic sludge was gasified. At Exeter, Leeds, Worcester (Mass.), and at Manchester it had been claimed for the septic tank that 25 per cent. of the organic matter had been gasified; but at Birmingham, where they had acres of septic tanks, the average for the past few years showed that only 10 per cent. of the organic sludge was got rid of in this way. Gasification, he maintained, was by no means the primary advantage of the septic tank; its most important function was that of reducing organic sludge to an inodorous condition. At Birmingham that was done, and a non-smelling sludge was ejected down the valley for three or four miles, when it was deposited in lagoons. By that means they got rid of their sludge at a small cost.

Before passing the septic tank effluent through the bacteria beds it was advisable to remove as much of the humus from it as possible. The Birmingham tank, which had the Dortmund tank as its prototype, was capable of removing 80 per cent. of this substance, leaving only 6 to 8 parts per 100,000 in the liquid as applied to the surface of the beds. Someone had said that it was advisable to eliminate all the solids before the liquid was sprayed over the beds, but this was impossible by natural means; but even if one were able to do so the unseen colloidal matter would change its character in the bed, and the resulting filtrate would contain solids. He had known beds receiving tank liquor with 6 parts per 100,000 produce as filtrate 17 or more parts per 100,000, proving that what was applied to the bed did not necessarily bear any relationship to what came off. Such differences are generally very marked in the spring, when percolation beds shed living and dead organisms in great numbers. This, if for no other reason, was why a large instead of small medium was a safer vehicle of purification.

Mr. Edward Ardern (Manchester Sewage Works, Davyhulme) said that anyone engaged in the problem of sewage purification must agree as to the importance of the question of the elimination of suspended matters, and also as to the effect on the problem of varying local conditions and difference in character of sewage.

It was necessary to consider what was meant by the term suspended matter, and in that connection he was glad that Mr. Watson had raised the question of colloids, as such matters must be considered as potential solids which eventually require to be dealt with.

It was quite possible, for instance, to obtain a tank effluent free from visible suspended matter, which would, however, in the course of further purification changes deposit solid matter.

This fact would have therefore to be borne in mind when considering the question of filtration of such a tank effluent through a fine grade medium, as

undoubtedly deposition of solids, together with organic growths, would take place on the surface of the filtering material, and the question of cleansing the medium would ultimately have to be considered.

How far roughing or straining filters were successful in removing the colloidal matters was not yet determined. The question of their use or otherwise would appear to be one almost entirely of cost.

The Dibdin slate contact filter had been designed with the view of obtaining maximum holding capacity, together with the maximum amount of surface contact, and was so constructed that the accumulated solids could be readily washed out by flushing *in situ*. The resultant sludge or slurry, owing to the oxidation changes effected during the resting periods of the filter, was free from offence, granular in character, and on weathering or application to land was further oxidised, and consequently its disposal would not present serious difficulty. There were many possibilities connected with the use of such a filter, especially as a means of obtaining the solid matters in such a condition as would facilitate their disposal.

Mr. J. T. Thompson (Chemist to the Leeds Sewerage Committee) said that the elimination of suspended matter from sewage, and the question whether this process should take place before or after the effluent had been oxidised on some form of filter, was the centre of controversy in the sewage world to-day.

Leeds obtained satisfactory results, both by treating clarified sewage and screened sewage containing most of its suspended solids, on percolating beds. The fall available at the works and other factors had to be considered before one could decide which process was the better for any given town.

Dr. Wilson had drawn attention to their method of treating screened sewage (containing 40 grains per gallon of suspended matter) on a percolating bed. This bed was 45 ft. diameter by 12 ft. deep, and the material consisted of 10 ft. of large slabs of destructor clinker packed edgewise, with two ft. of half bricks on the top. The 15 grains per gallon suspended matter in the crude effluent were not completely oxidised, but the solids were easily removed by settlement, giving a very satisfactory result. The normal flow of sewage on to this bed was 50 gallons per cube yard per day, but it was flushed with as much as 300 gallons per cube yard during storms, to wash out any accumulation of solids from the filters.

Dr. Fowler's remarks about the beneficial action of higher organisms in filter beds were very interesting; the ordinary brandling worm played an important part in keeping percolating beds porous, and in digesting the sewage solids. In spring enormous numbers of these worms passed into the effluent basins.

The cost of filling Dibdin's slate filter beds at Knostrop with the slate amounted to about 13s. per ton. Although given away, the material cost £7 per ton for splitting before it left the Festiniog quarries.

Double contact beds were built, the layers of slate being an inch apart. The primary bed was dosed in two fillings with about 230 gallons per cube yard per day of precipitated sewage.

About 80 per cent. of the suspended matter in the sewage passed out of the primary bed in a putrescent condition, and its capacity fell 18 per cent. in nine months, so there was very little sludge digestion. Moreover, this bed could not be restored to its original capacity by the delightfully simple method of washing out with a hose, as appeared to be possible at other works.

The same material was used for a percolating bed, but the effluents were generally unsatisfactory. In six months the aëration became so bad that the experiment was abandoned.

Although the Leeds results were not encouraging, it was quite possible that the huge banks of slate waste from Welsh quarries might be utilised as filtering material for the sewage of towns in the vicinity where the cost would not be so great.

Description of the Sewerage and Sewage Disposal Works of Leeds, with special reference to the Sewage Disposal Works and Lands at Rodley.

By G. A. HART, Sewerage Engineer.

THE City of Leeds covers an area of 21,572 acres, and had an estimated population of 470,268 in June, 1907.

The whole of the natural surface drainage of this area ultimately flows into the River Aire, which traverses the city from the north-western to the south-eastern boundaries.

The contour of the drainage area is irregular, and varies in level from about 70 feet above Ordnance Datum at the south-eastern outfall boundary, to about 530 feet above Ordnance Datum.

The basin of the river Aire contains several small valleys, which converge towards the river, and along them flow tributary streams joining the river on the north and south banks respectively.

The whole of the drained area of the city which has been provided with a system of main sewerage is laid out on the combined system, stormwater relief overflows being constructed upon the main sewers to convey any excess flood water into the natural watercourses from the sewers of the drained areas during periods of heavy rainfall.

The main outfall sewer, intercepting the greater part of the city, terminates at the existing sewage outfall works situated at the extreme south-eastern boundary of the city at Knostrop, at which point the dry-weather flow of sewage is pumped from the outfall sewer into settlement tanks, and therein treated by a preliminary process of chemical precipitation for the purpose of eliminating the suspended solid matter; and the liquid tank effluent is finally discharged into the river Aire at a point just below Thwaite Weir.

The average dry-weather flow of sewage at Knostrop amounts to 16 million gallons per day, and the gross total area of the existing sewage disposal works site amounts to 26½ acres.

The disposal of the deposited sludge upon this restricted area has been an insuperable difficulty. The Leeds Corporation are now remodelling and extending the existing purification works at Knostrop with a view to producing a thoroughly clarified tank effluent, and are about to erect sludge-pressing plant on the site for the purpose of reducing the liquid sludge deposited in the tanks into controllable and solid form. These

extensions, it is anticipated, will be completed within the ensuing six months.

There is a drainage area of 1,558 acres within the city area (situated on the north-western boundary, in the districts called Rodley and Bramley), which is provided with an independent sewerage system draining to a sewage disposal outfall works in the valley of the river Aire at Rodley.

The population upon this drainage area was in November, 1906, estimated to be 16,717 persons, the average dry-weather flow of sewage being 355,000 gallons per day, made up as follows:—

Dry-weather flow of sewage.	Gallons per day.	Percentage of total flow.	Gallons per head of the population.
Domestic flow ...	230,000	65	13·7
Trades flow	125,000	35	7·4
TOTALS ...	355,000	100 %	21·1

The maximum rate of dry-weather flow is equal to twice the mean rate. The minimum rate is equal to half the mean rate.

The trades flow consists almost entirely of discharges from woollen cloth scouring and dyeing industries, in which soap emulsion, indigo, and aniline dyes are marked characteristics.

The water-carriage system is universally adopted throughout the area.

The site of the Rodley Sewage Disposal Works was acquired under the powers of the Leeds Improvement Act of 1893. The gross area then purchased was 66 acres 2 roods 31 poles, which was increased by the surrender of 4 acres of land to the Corporation by the Midland Railway Company in return for the surrender by the Corporation of certain rights of way.

The sewage from this drainage area is conveyed to the outfall works through two main outfall sewers, which were completed in 1905, and which discharge into the sewage tanks situated on the higher portion of the site, and therefore command almost the whole of the lands available for sewage treatment by gravitation.

The Bramley outfall sewer siphons underneath the bed of the river Aire on to the sewage works site in a cast-iron pipe 30 in. in diameter. The Rodley outfall sewer crosses over the river Aire upon the bridge leading on to the site, in an iron pipe 15 in. in diameter laid as an inverted siphon. The two sewers converge into a common mixing

chamber, which leads into two preliminary detritus tanks, each 28 ft. long, 18½ ft. wide, and 10 ft. deep, and with a capacity of 32,000 gallons, giving a total combined period of sedimentation equal to about four hours' dry-weather flow.

After leaving the detritus tanks, the sewage is passed into a further tank, 73 ft. long, 65 ft. wide, and 9 ft. deep, having a capacity of 267,000 gallons, which is equivalent to a further period of sedimentation of twenty hours' dry-weather flow. From this tank the sewage is conveyed on to two bacterial beds constructed upon the continuous or percolating system.

No. 1 bed is 76 ft. in diameter, 9 ft. 6 in. deep, and contains 1,580 cubic yards of medium, which consists of alluvial gravel drift screened from the excavation upon the site, and varying in size from 6 in. to 1 in. The area of this bed is one-tenth of an acre. The sewage is distributed over the bed by means of an Adams-Cresset rotary type distributor. The floor of the filter consists of cement concrete, underlying brick drains covered with stone flags radiating from the circumference to a central well.

No. 2 bacterial bed is 118 ft. in diameter, 8 ft. deep, and contains 3,220 cubic yards of medium, which also consists of alluvial gravel drift, graded in size from about 6 in. in diameter at the bottom of the bed to about 2½ in. in diameter at the top. The area of the bed is a quarter of an acre. The sewage is distributed by a Candy-Whitaker rotary buoyant type distributor, and the filter floor radiates from the centre to the circumference: a collecting channel to intercept the effluent being constructed round the entire perimeter.

A dosing chamber has been constructed to each bacterial bed in order to allow of the sewage distributors being supplied intermittently with tank effluent during the hours of minimum flow.

In dry weather the whole of the sewage is first passed through the detritus tank and septic tank and thence through the bacterial beds. In time of rainfall, a maximum volume equal to six times the dry-weather flow is passed through the detritus pits, and one-half of this volume (or three dilutions) is subsequently passed through the septic tank, and a volume equal to two dilutions is then treated upon the bacterial beds: the remaining four volumes of stormwater is finally treated either upon land or upon a special stormwater filter constructed for the purpose.

If further treatment to the filtrate from the bacterial beds is required, it can be conveyed by gravitation on to an area of 23½ acres of land for final treatment by downward intermittent filtration or surface irrigation.

The general formation of the land filtration area used for sewage and stormwater purification consists of from 2 ft. to 6 in. of loamy surface

soil, overlying a bed of river gravel drift, but the subsoil of the higher portion of the ground upon which the tanks and bacterial beds are constructed is stiff yellow clay.

About 18½ acres of the filtration area is laid out by subsoil drainage, the main outfall land-drain being laid at an average depth of 4 feet, to which ordinary land-drain tile pipes, laid on the herring-bone principle, are connected.

320 cub. ft. of sludge, or 1·06 tons of dry solid matter, is removed from the two grit tanks per million gallons of dry-weather flow, and 74 cub. ft. of sludge (over 83° ₀ water) is removed from the septic tank per million gallons of dry-weather flow.

The sludge and detritus deposited in the tanks is discharged on to the low-lying land through drain-pipes connected to the tank by means of floating arms and sludge outlet pipes.

The sewage and stormwater from the tank is conveyed to the land-filtration area by a permanent sewage carrier, which follows along the contour and round the boundary of the farm lands.

The sewage lands are to a limited extent utilized for farming purposes, and there are farm buildings consisting of cow and cart sheds, grain store, together with a bailiff's house, which includes one committee room. There is also a workmen's mess-room, and an office provided for the bailiff.

During the year ending March, 1907, turnips, mangolds, oats, carrots, and peas were grown on 21 acres of ground, and 24 acres of permanent grass yielded 49 tons of hay. The yield of mangolds and turnips amounted to about 18 to 20 tons per acre.

The total capital expenditure upon the lands and works at March 31st, 1907, was approximately :—

Land, etc.....	£10,645
Works and Buildings	23,540
Total	£34,185

The working expenses of sewage purification for the year ending March 31st, 1907, exclusive of interest and redemption fund charges, amounted to £599 10s. 8d., which includes a sum of £322 15s. 0d. for repairs and renewals, being about £222 in excess of the normal expenditure usually incurred.

The expenditure upon and income from farming operations almost equalise each other. The expenditure under this heading last year amounted to £916 10s. 6d.

The average analyses of the crude sewage and effluents from the tanks, bacterial beds and land, (1) for the twelve months ending December, 1906,

LEEDS CORPORATION.

Rodley Sewage Works.

Average of Analyses for the Twelve Months ending December, 1906. Results in Grains per Gallon.

Analyses of	No. of Analyses.	Free Ammonia.	Albuminoid Ammonia.	Oxygen absorbed in 4 hrs. at 80 F.	Nitrogen as Nitrates.	Incubator Test.		Soluble Solids.	Suspended Solids.
						Oxygen absorbed in 3 mins. before incubation.	Oxygen absorbed in 3 mins. after incubation.		
Crude Sewage	46	1·66	·605	6·22	...	...	...	52·9	32·1
Effluent from Septic Tank	14	·815	·269	2·55	...	...	...	38·2	10·1
Filtrate from No. 1 Bed	38	·386	·204	1·84	·23	·640	·859	39·6	7·6
Filtrate from No. 2 Bed	44	·425	·199	1·59	·32	·692	·729	37·4	8·7
General Effluent	38	·342	·090	·707	·25	·268	·330	38·4	3·8

Average of Analyses for the Six Months ending June, 1907. Results in Grains per Gallon.

Analyses of	No. of Analyses.	Free Ammonia.	Albuminoid Ammonia.	Oxygen absorbed in 4 hrs. at 80 F.	Nitrogen as Nitrates.	Incubator Test		Soluble Solids.	Suspended Solids.
						Oxygen absorbed in 3 mins. before incubation.	Oxygen absorbed in 3 mins. after incubation		
Crude Sewage	20	1·93	·548	4·91	...	...	...	44·3	19·9
Effluent from Septic Tank	20	·990	·296	2·52	...	...	..	40·7	10·9
Filtrate from No. 1 Bed	20	·491	·186	1·677	·42	·579	·698	38·1	8·96
Filtrate from No. 2 Bed	14	·502	·170	1·598	·49	·545	·605	38·8	8·55
General Effluent	9	·417	·111	·843	·413	·257	·403	36·1	7·5

and (2) for the six months ending June, 1907, expressed in terms of grains per gallon, are as follows:—

CITY OF LEEDS. Plan of Municipal Area, and showing the areas draining to Knostrop and Rodley Sewage Disposal Works.

CITY OF LEEDS. RODLEY SEWAGE DISPOSAL WORKS.

DISCUSSION ON BUTTER SUPPLY.

Opened by L. WILSON,

Manager, Butter Dept., Co-operative Wholesale Society, Manchester.

At Sessional Meeting, Manchester, December 13th, 1907.

AS an article of food, butter is recognised as one of the most important of our dietary, and it is also important that it be pure and wholesome. In compiling this paper I have attempted to trace the methods used in the manufacture, from old days to modern times, showing the progress of the industry and the improvement that science has brought to bear in producing a pure article, which is so much appreciated and so necessary to modern life.

The system of making butter in use up to quite recent times was very antiquated. The milk was placed in shallow receptacles, allowing the cream to form, and as it rose to the surface it was skimmed off and placed in another vessel to ripen. To get all the cream from the milk this process was repeated. The cooling of the cream had to be effected by cold water, which at many periods of the year was too high in temperature to give good results. After standing to ripen for some time, it was then put into an old-fashioned barrel churn worked by hand, which was a laborious operation.

When the butter had formed into granules it was taken out of the churn, placed in a large tub, and washed well with cold water until all the buttermilk was extracted. It was then salted to the taste of the various consumers, and the custom in England then, as in the present day, was to make it up into pats, rolls, or prints, which were generally sold on the local markets where it was produced.

The qualities were, and are, very varied, and from thirty different farms there would be almost as many qualities.

In Ireland the same methods obtained, but the farmers there produced mainly for export and long keeping. Therefore they salted it heavily, and packed it into oak firkins of about 70 lbs. each. Ireland for many years was

our chief source of supply. Having a magnificent pasturage (which is still described as the finest in the world for the production of butter), the Irish made this their staple industry, and up to forty or fifty years ago the farmers were doing well. The quantity made in the late summer and early autumn was, for keeping purposes, heavily salted, and was bought by English firms, who stored it for use through the winter and following spring. The quality at the finish of these stocked butters was not all that could be desired, and when being taken out of the firkin the odour was unpleasant. Scraping and the hose-pipe had to be requisitioned to effect a semblance to sweetness.

This class of butter rose to very high prices in the winter, and as much as 140s. to 150s. per cwt. was paid in those days. To-day 93s., or thereabouts, represents its value.

The Irish farmers, contented with their position, took no pains to improve the quality or develop the industry. Then came the reaction. About thirty years ago the Danes, seeing what a field was open to them, resolutely set themselves to be our butter suppliers, and with commendable earnestness, backed up by their Government, they adopted up-to-date and scientific lines, and soon wrested from Ireland the trade, which they have since maintained. The butter they manufacture at the present time is recognised as the leading quality that is imported into England, and the standard to which all other producers try to attain.

This was the dividing line between the old and the modern style of making butter. Machinery played a very important part in the manipulation, and from the commencement to the finish the product was not touched by hand, a wonderful revolution in method.

Denmark, encouraged by its immediate success, strained every effort, and the best brains of the country were engaged in inventing and perfecting machinery to produce butter in the most scientific and cleanly way. Large white wood casks were adopted for packing, which very favourably contrasted with the brown wood firkin from Ireland, and there was a neatness and cleanliness exercised that appealed to our people forthwith.

In adopting the new method, the Danes adopted the creamery system worked on co-operative lines, the farmers combining by subscribing share capital and sending their supplies of milk to be made into butter.

A creamery may be described as follows:—In the first place the site is carefully chosen with a view to having a good water supply, as this is most essential for the purpose of clearing away the refuse. The building is perfectly ventilated and well lighted, with concrete floors,

which, with a plentiful supply of water, can be kept clean after every churning. It is fitted up with the following machinery:—separators, pasteurizers, revolving churns, refrigerators, and butter tables. The process is as follows:—On receipt of the milk, it is weighed, and samples taken for ascertaining the amount of butter fat each lot contains (on which the basis of payment is fixed); it is then released into a large tank, from which it flows into the heater inside the dairy, where its temperature is raised to 120° F. before going into the separator. This divides the milk, forcing the cream through one tube and the separated milk through another. The cream then passes to the pasteurizer, where it is raised to 170° F., which quickly destroys any germs that might injure the cream. It then passes to the cooling pans, reducing the temperature to 70° F. The separated milk is treated in the same way, and then passed into a tank, from which each supplier receives his proportion.

The cream is then placed in ripening vats for about twenty-four hours, and after ripening is transferred to the churns, which revolve for about forty minutes, during which time it is converted into butter. The washing process then follows, cold water being poured into the churn to wash the buttermilk from the butter grains; the water is then drawn off, leaving only the butter granules. These are taken from the churn with a hair sieve and placed upon the butter table, which is fitted up with fluted rollers, where it is worked, extracting the moisture; after that it is salted. The table is again set in motion to disseminate the salt equally, after which the butter is removed from the table and put into casks or boxes, when it is ready for shipping.

During all this process it has not been touched by hand; wooden spoons or spats being used to handle it, so that it will be seen the utmost care is used to turn the butter out in the cleanest possible manner.

Such, then, is a brief description of butter making under the old and new systems. Farmers in Ireland who can afford it have adopted hand separators, with which they save much labour and, at the same time, improve the quality.

Ireland allowed Denmark to forge ahead, with the result that Irish butter soon lost its lead on the English market. About twenty years ago there was an attempt to copy the Danes, by erecting creameries and manufacturing on the same lines, but it was not until 1893 that any serious move was made.

The Co-operative Wholesale Society were the pioneers in the movement, and in that year erected their first creamery, which turned out over 1,000 cwts.

They continued to erect creameries during the following ten years, and at the end of last year owned 87 main and auxiliary buildings in the south and south-west of Ireland, the finest lands of the country, and the amount of milk received during last year was 13½ million gallons.

The action of the Co-operative Wholesale Society stimulated the Irish people, and dotted all over the southern and western portions of Ireland, also in the north, creameries have been erected; and, in addition to those owned by the C.W.S., there are at least 500 owned privately and co-operatively.

Thus was a dying industry revived in Ireland, and at present it is computed that about 60,000 tons of creamery and salted butter are produced annually.

When creamery butter came to the front, the production of salted began to decline, as the public taste veered round on to the milder qualities, and the following figures show how the change has worked. The principal salt butter market in Ireland is Cork. In 1878 the total number of firkins which passed through this market was 442,000, and in 1905 it was only 34,500.

The average number of milking cattle in Ireland is about 1,500,000: and the land, if laid down to pasturage, is computed sufficient to feed at least five million milking cows and an equal number of young stock.

Dealing with the imports, which for the year 1906 amounted to 216,917 tons, Denmark takes first place with 83,788 tons, or over one-third. Russia, which includes Siberia, comes next with 20,327 tons, and it is notable that in 1897 we did not receive any butter from there. This shows what a remarkable progress has been made in a decade, and everything points to Russia and Siberia taking the leading position as regards the quantity produced.

The countries who supply us with butter, with the quantities, are given below:—

Country.	1905.	1906.	1906. *(10 months)*	1907. *(10 months)*
	Tons.	Tons.	Tons.	Tons.
Denmark	81,518	83,788	71,263	77,349
Sweden	9,410	9,140	7,686	9,996
Russia	23,057	30,327	27,410	30,261
Germany	268	535	513	332
Holland	10,495	9,768	8,569	7,372
France	17,422	15,970	14,230	12,085
United States ...	4,244	7,865	7,767	3
Canada	14,605	9,605	9,219	1,730
Victoria	11,378	14,360	9,725	11,154
New South Wales	8,427	9,032	7,071	8,938
Queensland	2,709	3,899	3,453	4,538
New Zealand ...	15,020	15,583	13,415	13,820
Other Countries	8,837	7,045	5,406	4,353
	207,390	216,917	185,727	181,931

This shows an increase over 1905 of 9,527 tons, or 4·59 per cent., but the first ten months of the present year, as compared with 1906, show a decrease of 3,793 tons, or about 2 per cent.

The total value of the imports from all countries for 1906 was £23,466,252, an increase over the preceding year of £1,880,630 or 8·71.

The average yearly production in the United Kingdom is estimated at 85,000 tons, as against average importations of over 200,000 tons. What a grand chance for our agriculturists! Deducting what we paid to our colonies, viz., £5,539,600, there are almost £18,000,000 going to foreign countries for an article of food, of which a great portion could be produced in the United Kingdom if agriculture was more encouraged and assistance given by our Government, such as is done in Denmark. There is wide field for enterprise, and one that will help to solve the unemployed question. The "back-to-the-land" idea is workable if attention is paid to this important and paying industry, but our legislators must recognise that it is absolutely necessary to foster and encourage our farming community by establishing colleges and laboratories for training students, and, if necessary, to advance money to farmers to buy stock and farming implements; also to appoint experts, who will always be available, free, to advise and to remedy any faults that may arise in butter manufacture.

The Danes recognised at the start that to be successful they must be prepared to supply butter all the year round, and they therefore arranged that part of their cattle should calve in the autumn, thus ensuring a good supply of milk during the winter months.

The Irish have not followed this system, and practically all their cattle calve in the springtime, so that there is very little butter made during several months of the year.

The C.W.S. have agitated for some years for the adoption of winter dairying in Ireland, and during the past two or three years there has been some effort made, but only in a small way. The lack of housing accommodation for the cattle and the Irish farmers' disinclination to adopt this system, owing to the insecurity of land tenure, are the main drawbacks, but it is now being recognised that if Ireland is to improve her position steps must be taken, and the Board of Agriculture and Fisheries have instituted an agricultural department in Ireland with the ostensible purpose of improving the position of the farmers.

Under the present system the bulk of the butter is produced during the months of May to October, thus causing values to rule low during this period, whereas if the production was extended over the whole year it would tend to keep prices on a more remunerative level.

There has been a great outcry for some years against the adulteration of food, and particularly so with regard to butter. Unscrupulous people found there was a rich harvest to be gathered by "faking" or manipulating pure butter, and have foisted upon the public an impoverished article robbed of its nutritive qualities to about 20 to 25 per cent. They invented costly machinery to knead the butter, and then they added milk, neutral fats, lard, cocoanut oil, caseine, or vegetable oils, which were so subtly blended that analysts have been deceived, and have certified samples as pure. Large manufactories have been erected and hundreds of tons of this sophisticated article turned out and sold as pure butter.

This led to a great agitation for legislation to put a stop to this pernicious system, and a Butter Bill has been before the House of Commons for several years, but it is only this year, however, that a new law regulating the sale of butter and margarine has been passed, which comes into operation in January next. It has been common knowledge that the Dutch people have been great transgressors in this respect, as well as some of our own people. New Zealand, Australian, and Siberian butters, which are known to contain the least moisture, offered the greatest plunder to the manipulators, and thousands of boxes have been

shipped to Holland from England to be "faked," and then re-shipped for the English markets.

Rancid, off-flavoured, tallowy stuff, that in many cases ought to have been relegated to soap-making, has been re-worked and palmed off on the public.

The Wholesale Society, in the interests of co-operators, issued over 500,000 leaflets early last year, warning them of the audacious frauds that were being perpetrated, and advising them to avoid the spurious and fraudulent qualities that were on the market, and to purchase only from their own stores, which were supplied by the C.W.S. with guaranteed pure butter. Being manufacturers we know what we produce is pure, and our representatives all over the continent and the colonies, collect direct from the dairies and factories only what is pure; also, we in England do not buy anything but the pure article.

Another method of deceiving the public was the speciously worded milk-blended article. As everyone knows, butter is made from cream extracted from milk; why, then, should it afterwards be blended with milk? It was practically adding so much water, as the constituent parts of milk are 85 per cent. of water.

The new law deals effectively with the foregoing; in fact, too drastically for the honest British importer, who is entirely at the mercy of the exporter. When any imported butter is found by analysis to be adulterated, the importer is liable to a fine equal to the value of the goods imported bearing the same mark or description.

To illustrate a case. A merchant imports 100 casks of butter. A sample is taken and found adulterated. If those 100 casks bear the same mark or description, the amount of the fine would be £500, for possibly one faulty cask.

Milk-blended butter is still allowed to be made, but not to exceed 24 per cent. of moisture; but it is not to be sold by the name of "Milk-blended," or any other name indicative of butter or the dairying industry.

The Government caused much surprise to the trade by its persistence in legalising such an article, which was objected to by fully nine-tenths of the grocers' associations of the United Kingdom; but with all the opposition, it was placed on the statute book.

When the Select Committee of the House of Commons was examining witnesses last year, evidence was given that fraud was rampant in the faking of butter; and one case was cited where a firm was approached, being offered an adulterant which would ensure them an extra profit of £5,000 per year. The same witness mentioned that a firm, not in

England, were making £20,000 a year clear profit out of this mixture. These are the firms that the Bill is aimed at, but unfortunately the honest importer will have to suffer for their misdeeds.

The sale of margarine is also regulated by the new Act. At present fancy names are used, with the object of misleading the public into the belief that they are getting butter. Next year fancy names will still be allowed, but they must not refer to or indicate butter or the dairying industry.

There are many firms who work the multiple-shop system, who widely advertise margarine as the "finest butter substitute," ignoring the word margarine in their advertisements. They give with every pound sold an extra half-pound, and with every half-pound they give a quarter-pound, and so on proportionately. This, I think, ought to be stopped, as in the case of the liquor trade, where the system of giving the "long pull" has been made illegal.

From the following figures you will be able to judge how deeply the C.W.S. are interested in the butter question, and anything that can be done to advance the development of the industry in the United Kingdom will receive their hearty support. Total weight of butter sold during 1906, 644,736 cwts., value £3,626,174.

Dr. Meredith Young (Stockport) said that it was highly important that they should view this subject from as many sides as possible, and Mr. Wilson represented a section of those interested in the sale of food matters who did not voice their opinions sufficiently often. Speaking as a medical officer of health, he felt that it was frequently lost sight of that many invalids, especially dyspeptics who could not digest carbohydrates (sugars and starches), because of fermentative trouble, had cream or butter prescribed for them. Now, cream was often bad for dyspeptics, because it was in the form of a neutral fat which had to be split up into glycerine and fatty acids before it could be digested. Butter, on the contrary, contained nearly 8 per cent. of volatile fatty acids, and was well on the way to being ready for absorption. Indeed, many observers said that rather than add cream to milk in the case of children who were living on milk it was better to add butter to the diet, because cream had a retarding effect on the digestion of the proteids in milk, whereas butter was already more than half digested. The importance of this in a patient suffering from amylaceous dyspepsia was very great: if carbohydrates could not be digested, and butter fat was not supplied, bodily energy would soon go down and debility would ensue.

But if the patient got a butter-substitute instead of butter, he was getting a substance which was more difficult of digestion, which had only ½ per cent. of volatile fatty acids, and which had not, therefore, the same food value to him. His advice to those who could not afford pure butter was to give preference to margarine and to avoid the milk-blended article: margarine was lower in price and, weight for weight, was more nutritious than milk-blended butter. There was a constant duel going on between the public analyst and the butter-faker, and as soon as the analyst detected one form of foreign fat the faker set to and invented another combination. They had the milk blend, the curd blend, the foreign-fat blend, and the margarine blend, and they would doubtless have many more blends as time went on. The worst of it was that there were firms existing, who, for £50 or so, were willing to sell a secret to butter makers, showing them how to fake their butter and make about 5 per cent. more profit at the expense of the pocket and probably of the stomach of the public. Worse than that, there were scientists and lawyers who, for a handsome fee, would teach the butter faker how to evade the law. This prostitution of knowledge was a disgrace which could not be condemned in sufficiently strong words. Coming now to the Act of 1907 regulating the manufacture of butter and its allies, the inspection of places where butter and margarine were made was still left chiefly in the hands of the Board of Agriculture or the Local Government Board. Section 2 of the 1907 Act gave power to the officer of the local authority if specially authorised, to enter, inspect, and take samples in the case of any butter factory registered by his local authority. This meant that most of the premises would still be under the inspection of the Board of Agriculture or Local Government Board, an inspection which could only be termed intermittent. The local authority's inspector, though he might find unregistered premises in which he suspected that the manufacture, blending, reworking, treating, or wholesale dealing of butter, etc., was being carried on, had no power of entry. Presumably he would report to the Board of Agriculture, and by the time their inspector came down the business may have been transferred elsewhere. That course of procedure was advised in the Board of Agriculture's Circular of December 12th.

As regards excess of moisture, there were apparently three lines of action open against this form of adulteration. The 1907 Act left the Board of Agriculture regulations as to water in butter unrepealed. Hence they could still proceed under these. But as regarded the standard for water in butter and margarine, despite the decision in Roberts v. Leeming, any local authority taking proceedings must be prepared to prove by expert analytical and manufacturing evidence that anything over 16 per cent. was an excessive amount. This decision merely stated that the bench which heard the case had evidence before them that 16 per cent. was a reasonable limit, and anything over that was excessive, and the King's Bench would not interfere with that decision. The Justices, then, must on the evidence before them fix a standard, and if they did the High Court would not interfere with their decision. The

next way in which excess of moisture over 16 per cent. could be dealt with was under the 1907 Act, section 4, in cases where the butter or margarine was in a factory or was consigned from a factory. Here the occupier of the factory or the consignor was guilty of an offence, unless he proved to the court that the fat was not made, blended, reworked, or treated in the factory. But local authorities' inspectors could not go into margarine factories, only into butter factories, because, forsooth, of the fear of their seeing and giving away trade secrets. The inspector must therefore find out from whom the consignment came, and take proceedings against him. All the formalities as to taking samples, analyses, etc., were apparently to be carried out as prescribed by the 1875 and 1899 Acts, and the Margarine Act of 1887. If the adulterated butter or margarine came from abroad the importer was the person liable, and he apparently would have to take proceedings for breach of contract against the person who sent it to him. It appeared a little hard that he should be the one to suffer. Section 3 of the 1907 Act was in his opinion weak. It stated, first, that if any substance intended to be used for the adulteration of butter were found in any butter factory the occupier was guilty of an offence; and, second, that if any oil or fat capable of being so used was found, it was to be deemed to be intended to be so used unless the contrary were proved. The crucial point of the section was proof of intention, and though the state of a man's conscience (and probably also of his intentions) were as much a matter of fact as the state of his digestion, this fact was difficult to establish, and he advised any of them who had to carry out this part of the Act to go about it in a very careful manner. They all knew how difficult this question of intention was in bad meat cases, where the onus of proof that the meat was not intended for the food of man was thrown on the party charged. Under the Butter Act they had to bear the burden of proving that the substance found in the factory was intended for adulteration. The legalisation of the sale of milk-blended butter, which might, under the Act, contain 24 per cent. of water, was, he thought, regrettable. People who bought butter, even if they were pretty well educated, did not know what 24 per cent. meant (that it amounted to almost a quarter of the total), and they had the idea that the blending of milk was done with the idea of enriching the butter. Parliament was sanctioning a veiled fraud on the public, and, what was worse, on the poorest section of the public. Parliament had exhibited an armour-plated indifference to representations as to this matter, and the new Act would probably result in a large increase in the number of firms making the milk-blended article. The part of the Act dealing with what butter substitutes were to be called was again half-hearted; it was now left to the Board of Agriculture to approve of a name for them. If this Board were not a good deal more downright in their methods than they had been in the case of milk regulations, he feared the results of this section would not be worth having. The most serious defect in legislation as regarded butter (and the same applied to many other articles of food) was that although they

took a sample and the vendor even confessed it was not what it pretended to be, he still was allowed to go on selling it, and by the time the analyst's certificate came and proceedings were begun he might have sold a few tons of it. What they wanted was some power to put an embargo on all suspected food until the receipt of the certificate, and if it proved to be adulterated the power of confiscation and destruction of the whole consignment, or at least the power of sale in some such place and in some such manner as meat in the German *Freibanken*. As regards sampling, the compulsory division of the sample was one which at times worked to the detriment of the detector of adulteration. The chief victims of butter frauds were the poor people who bought it a few pennyworths at a time. If an inspector or his agent asked in certain neighbourhoods for a quantity which would bear division into three parts, and leave enough in each part to bear analysis by certain analysts, suspicion was often aroused and the dishonest vendor was not caught. A good method was to set two inspectors on to follow each other: the first might get a genuine sample and the second a fraudulent one. Many magistrates might say this was not a fair way of acting, that it was setting a trap for the dealer, and the speaker was virtually censured because he sent to the infirmary three days running to take milk samples. The bench evidently thought a dealer had a right to adulterate occasionally. One could not help comparing the manner in which this kind of trap-setting was viewed by the average bench with that in which they gloated over the catch resulting from the setting of motor-traps. They were still in want of a comprehensive and reliable standard for butter, and in his opinion they could not do better than copy the 1906 Australian Act, which fixed the following:—

Butter fat	82	per cent.
No other fat than butter fat.		
Water not to exceed	16	„ „
Casein.....	3	„ „
Boric acid	0·5	„ „
Salt.....	4	„ „

Such colouring matter as the Minister of the Commonwealth shall adjudge harmless. Here he thought they had every possible form of adulteration guarded against, and he hoped they would soon get something as useful in the mother-country.

Mr. Robert Bell (Assistant Prosecuting Solicitor, Corporation of the City of Manchester) said that Dr. Meredith Young had discussed and criticised the Butter and Margarine Act, 1907, in a manner which showed that he was not at all satisfied with its provisions. Mr. Bell pointed out that although there was much cause for disappointment and regret, yet the fact that the Government had apparently realised the importance of the adulteration question was a matter for congratulation. He pointed out the advantage of some of the sections of the Act, and explained the same; also certain difficulties in pursuing the "false warranty" sections of the Food and Drugs Acts where the original consignor was out of the jurisdiction, and suggested

that it would be better if, where people were allowed to consign food for consumption in this country, they could be made amenable to the laws of the country. In conclusion, he thought that it would be an advantage if the Government analysts would make known the method of their analysis, so that public analysts might work on the same basis with a view to arriving at the same conclusion; and that it was a pity that more assistance was not given by Government analysts to public analysts in this direction; as an instance of such want of method he quoted a case recently reported in the papers, where the analyst for the prosecution, the analyst for the defendant, and the Government analyst all arrived at different results.

MR. A. T. ROOK (Manchester) quoted figures from a report which he made ten years ago on the milk supply to the city. The bulk of the milk consumed in Manchester and its suburbs was obtained from Cheshire and Derbyshire; other supplies were received from Staffordshire and Lancashire, and a small quantity from Shropshire. The bulk of that produced in Lancashire was consumed in other large towns in the county. The various railway companies delivered to railway stations in and within a four-mile radius of the city 10,363,432 gallons a year. In about the same area the number of cows kept was 3,085. It was estimated that the yield of a cow kept in a town or suburb, and fed on forcing food for the purpose of producing a large yield, in many instances regardless of quality, was about ten quarts per day. Taking this estimate, the quantity produced from 3,085 cows for a year was 2,815,062 gallons. A further supply was brought in by cart from farms within a radius of about eight miles of the city. From that source it was estimated, after very careful inquiry, that about 1,500,000 gallons were received. Of course, a very large quantity of the milk produced within the eight-mile radius was delivered to residents in the districts in which it was produced, and that had been duly considered in the calculation. That gave a total supply from all sources of 14,678,494 gallons a year. Taking the estimated population of the city as 531,697, that would give the proportion of consumption as 8,640,076 gallons, or about sixteen and a quarter gallons per head per year. The average retail value of the milk being 3d. per quart, the citizens paid for that article of food alone £432,003 16s. per annum. The efforts of the committee to prevent adulteration during the last twenty-two years had resulted in reducing the percentage of adulterated samples from 33·33 in 1875 to 2·01 in 1897; and to show the importance of the steps taken in that direction, it might be stated that if the milk consumed by the citizens was adulterated with only one per cent. of added water, it would mean in money value about £4,320 per year.

MR. J. T. QUINTON (Liverpool) also took part in the discussion.

DISCUSSION ON SMALL DWELLINGS,

Opened by Prof. J. RADCLIFFE, M.Sc.(Tech.)

(FELLOW.)

At Sessional Meeting, Manchester, December 13th, 1907.

IT is now fully recognised that the housing of the people is of supreme importance to the welfare of any country. The life and power of the Nation depend upon it. Experience has taught those having the control of large armies, that neglect of matters connected with the housing of the troops may entail greater suffering and loss of men than the guns of the enemy. The care which is of so much importance to the Military, is essential in the case of our industrial armies, as the encampments of the latter are permanent, and the density of the population is greater.

Speaking generally we may say that the Government of this country has acknowledged its responsibility and given extensive powers to local authorities for the purpose of dealing with this important question. Much has been done by philanthropists and private enterprise. The statistics compiled by the Registrar-General, and the detailed information collected by the medical officers of health, may be used with confidence to indicate the success or otherwise of the efforts made to keep pace with modern ideas regarding sanitation.

We often forget, that when the dwellings that are now adversely criticised were built, many of the now recognised laws of health were not known, and that the buildings now condemned were at that time considered by experts to be satisfactory. Research work has been carried on since that time by a large number of enthusiasts, and experience has furnished facts which prove beyond doubt that a large part of the population of this and other countries are living under conditions which not only shorten the life of the individual, but render him less able to support himself and those dependent upon him.

Though knowledge of the laws of health has spread with rapidity, it has not yet reached certain sections of the community, or its influence has been neutralized by antagonistic forces of a stronger character. The

result may be seen not only in towns but in many rural districts, though in the latter the consequences are not so disastrous, owing to the smaller density of the population and the purer character of the atmosphere. Usually the oldest parts of a district present the greatest difficulty, but something has been done to reduce the density of population in areas, and in houses, and to improve the condition of the dwellings and surroundings.

Those engaged upon this work know that the task is very difficult, the progress costly, slow, and at times almost disheartening, owing to the varied interests affected. No uniformity of procedure is possible, as the conditions and requirements of each district vary so largely. The financial side of the question has prevented effective action in many cases, and the enormously rapid increase of expenditure by local authorities, has caused great uneasiness amongst those responsible for the repayment of the borrowed money.

Many large towns, including Liverpool, have, after very careful consideration of the whole question, spent considerable sums in their efforts to remove the evils of overcrowding and insanitary dwellings. But can any of the men responsible for the work say that the result has been an unqualified success? Small areas have been cleared of old and overcrowded houses, and in their places large and costly buildings have been erected for, but seldom occupied by, the class of persons disturbed by the clearance of the unhealthy area.

The writer recently visited a block of dwellings erected, at considerable cost, by a local authority. In one of the dwellings, which cost about £320, he found a woman and three children in a very dirty condition and practically in rags. The woman's husband, a cooper, could earn about £2 per week when he cared to work. The question arises, is it fair to the ratepayers, or good for the man, to spend this money to house him and his family in their present condition, and at a low rent, so that he may have more leisure and money to spend on drink? The true answer cannot be in the affirmative.

Towns smaller than those previously mentioned have their unhealthy areas, but hesitate to adopt the remedies which their brethren with financially stronger backs have thought it advisable to carry out. In a report recently issued on the cost of rehousing, it is stated that the net cost per person of the working class displaced by clearance schemes varied from £5·2 to £37·3, and that the expenditure per room provided was £109·3. The figures quoted are in themselves sufficient to make those responsible for the payment hesitate to take action.

It is now generally acknowledged in this country and in Germany

that the housing of a large number of families in huge blocks of buildings is a mistake, and should be discouraged and, wherever possible, prevented. Strenuous efforts should be made to spread the people over a wider area. With this object in view garden city schemes have been launched and are meeting with a considerable amount of success: the owner of the land, the purchaser, and the local authority sharing in the benefit. The landowner, by dividing his land into small plots (say of 1,200 square yards), is able to sell his land, which was valued at £60 per acre for agricultural purposes, at the rate of £200 per acre. The purchaser secures for £50 a plot of land, upon which he can erect a suitable house for himself and his family at a reasonable rate. In such cases, the local authority, without incurring cost or responsibility, succeeds in spreading the population under satisfactory conditions, increasing the rateable value of their district, and improving the appearance of their surroundings.

An important question may now be asked: Have the efforts which have been made at enormous cost really improved the individuals, or the conditions under which they exist, in the old and overcrowded centres of our population? That there has been an improvement is beyond doubt, but only the fringe of the matter has been touched by the efforts of the house reformers. In the majority of cases the dwellings provided by them are of a too costly character, and are out of the reach of the individuals it is intended to improve, and therefore the result is almost failure.

At the present time there are four principal and distinct bodies working enthusiastically in the field, namely, the house reformer, the temperance worker, the educationalist, and the religious worker. Each one conscientiously believes that his theories and remedies would bring salvation. All should work together for the common good; but the house reformer and the educationalist are very closely associated in this matter. A great amount of permanent good would result from the proper training of the children from this low stratum of society; if not trained they will remain ignorant of the benefits resulting from education and an observance of the laws of health. The result would not be immediately shown, but a gradual improvement would certainly take place.

The house reformers (which term of course includes the local authorities) should not relax in any way their efforts to improve the homes of the people. There are, however, many enthusiasts connected with that body of estimable workers who have a high ideal, and nothing short of that ideal will satisfy them; some go so far as to condemn in strong terms anything less perfect, and overlook factors which cannot be neglected if success is to be achieved. The poverty of the people is one which must

be considered. There are two classes of poor people, namely, the respectable poor, and the undeserving poor. The poverty may be the result of one or more of the following causes:—

Average income too small, owing to the unskilled nature of work done, or to the work being irregular. Inability to find work or insufficient of it. Improvidence in case of men with seasonal trades, or of unskilled labourers with precarious employment. Improvidence in case of families making no provision for sickness where the income made it possible to do so. Improvidence in other ways (*e.g.*, reckless marriage and extravagance in living, and waste of food). Desertion (generally by husband). Dishonesty or other serious misconduct which renders labour less marketable and less valuable. Drunkenness. Laziness or deliberate and habitual disinclination to work. Old age. Misfortune (*e.g.*, long and severe illness, decaying trade and consequent real inability to get employment). Inability due to mental or physical weakness.

The respectable poor suffer because of old age, misfortune, and real inability to work. They require houses at a low rent and experience no difficulty in obtaining them, because they keep them clean and generally manage to pay the small amount regularly to the landlord.

The undeserving poor cannot get houses, because they will not pay for them or keep them in a satisfactory condition. It is this section of the poor that is at the root of the difficulty. The demand for houses by such people has created the supply. Premises are now used for this purpose that should have ceased to exist years ago. The property has paid for itself many times over, and is now farmed by unscrupulous persons (who will not spend money upon it except under compulsion), and who squeeze the maximum amount out of it regardless of the consequences.

Recently a large block of this kind of property fell into the hands of the ground landlord. This gentleman did not want to be known as the owner of the property, so he offered to give the houses on condition that a ground rent should be paid to him regularly. His influence was such as would prevent the receiver of the rents being harassed by the officials of the local authority. Many cases of a similar character might be cited, and numerous instances given of responsible officials making special efforts to devise a method by which they would not be compelled to take action in such matters. To be successful in the efforts to lessen the evils of bad housing and overcrowding may involve a substantial increase of salaries to the officials concerned. Parliament has given local authorities powers to prevent the occupation of premises unfit for human habitation. Local authorities should be compelled to use these powers, and the ground land-

lord should share in the responsibility along with the so-called owner of the property.

The medical officer of health and the sanitary inspector should be able to take action without fear of the consequences; but this is almost impossible on account of local influence and the many interests which must be considered.

The appointment by the Local Government Board of inspectors to periodically and systematically visit and inspect each district throughout the country would meet the case, and result in great improvement. An official of the County Council would not be sufficiently independent. The principle is applied with success on a small scale in the case of canal boats.

The house reformer is often an extremist who would sweep all small dwellings away (including back to back houses), and insist upon having only houses of modern construction built in accordance with the ordinary building by-laws. This often leads to overcrowding, and is to a great extent a mistake, as the rent of such houses is usually more than the poor can or will pay. Many of the small houses are in a good habitable condition, clean, openly situated, and quite satisfactory (if not overcrowded) for certain sections of the poor. But houses of this kind should be carefully watched to prevent overcrowding and other insanitary conditions, especially when such houses are known to be occupied by the disreputable poor. Houses of this kind might be registered to accommodate a fixed number of occupants. Power should be available to prosecute for dirty houses or filthy persons: and the person who receives the rent should be, to some extent, responsible for the condition of the premises.

Many of the small dwellings that are now rightly condemned could be permanently closed or made habitable if the local authorities would sink private interests and exercise the powers they already possess. Constant supervision of this class of property is necessary. The privacy of the home and liberty of the subject, important as they are, must be invaded where a person insists upon occupying a house in a condition which makes it dangerous to the public.

A gradual reduction in the number of low class dwellings would take place if the above mentioned suggestions were adopted, and provision would have to be made for housing those who could not obtain habitable dwellings.

It is, however, inadvisable to house the class of people referred to in large numbers under one roof. Low buildings and wide open thoroughfares are preferable. The conditions which regulate the price of land in

the immediate vicinity of our towns interfere to a considerable extent with the improvements that would otherwise be carried out. The owners of land occupied by blocks of premises proved to be insanitary should in case of non-compliance, after reasonable notice, to remedy the defects on their land, given by the local authority, with the approval of the Local Government Board, be compelled to sell the land to the local authority, if they desire it, for the housing of the people, at a price based upon the average actual receipts during a past and fixed period. Where there is a dual ownership of property, or when the buildings are owned by a short leaseholder, or where the interests in the property are numerous, conflicting, or disputed, the same principle should be made to apply, and nothing given for prospective improvement in value. The price awarded or agreed upon should be allocated, where necessary, by some authority, amongst the different interests or claimants (as in cases under the Workmen's Compensation Act) or the amount paid into court, as in certain cases under the Lands Clauses Act. This would obviate delay in obtaining possession, and overcome difficulties which might exist in the title. This question is a complex one, but serious defects require strong remedies. As previously stated, many owners of land are simply farming their land, by allowing old and dilapidated property on it to be occupied until it is required for other purposes which will bring in more revenue.

Local authorities might with advantage be granted more extensive powers than they now possess for the purpose of acquiring land for housing. The usual period allowed for the repayment of capital expended should be lengthened as the security is good and does not depreciate.

It is the opinion of the writer that local authorities cannot build or manage small dwellings economically, and that it would be advisable to let the land for a period of twenty-one years, under stringent conditions, to persons accustomed to this class of work. At the end of that period the buildings would fall into the hands of the local authority, who would then have power to extend the lease or take down the buildings and relet the land, as they may think desirable.

Houses cannot be built in accordance with modern by-laws and let at rents which the poor can pay. The class of house usually built is unsuitable for the purpose, as it is not sufficiently open for inspection, and in many cases the arrangements prevent free circulation of air. The local authority should (with the approval of the Local Government Board) therefore have power to modify their by-laws for the erection of houses on areas of this kind.

The cost of the land, the cost of the building, and the usual charges

which are paid by the owner of the building, should be reduced to a minimum. In extreme cases preferential rating for a limited period might be resorted to, so that the rent to be paid by the tenants of the houses may be as small as possible, and at the same time allow the builder to obtain a reasonable return for his outlay, and to repay the capital sum expended at the termination of his lease.

Some help might, in extreme cases, have to be given to the builder to enable him to get back his capital and interest in twenty-one years. This help might be given in total or partial exemption from rates, a nominal ground rent, a subsidy, or some payment at the end of the lease. The better housing of the poor is an object worth some financial sacrifice.

Under the above-mentioned conditions the ordinary ratepayers would not really suffer, and the liability of the local authority would not be increased beyond the purchase price of the land, from which a return would be obtainable in many cases.

Conditions are often imposed by Parliament upon railway companies and others who desire to carry out public works, regarding the rehousing of persons to be displaced by the proposed works. Local authorities might take advantage of this, and arrange for a joint scheme for housing the poor of their district.

Many schemes for providing small houses have been prepared, but under ordinary conditions the existing by-laws prevent their adoption. The accompanying designs are, in the writer's opinion, such as would meet difficulty as regards rent, if the by-laws could be modified as suggested, and the buildings constructed and managed by a person accustomed to this class of property.

Each house is a separate dwelling containing a living room of reasonable size and two bedrooms, also of moderate size. The bedrooms are separated by a partition open at the floor and ceiling; each bedroom has a large window and is fitted with a firegrate and chimney. The floors and roof are solid, and the walls are plastered with cement so that no objectionable matter can accumulate. A free passage is provided for air through the premises on the ground and upper floor. Behind the living room provision is made for the staircase, coal store, and a set-boiler for washing clothes. A sink and separate w.c. are also provided for each house. The ashbin is contained in a recess which can only be opened from the outside.

There are no back premises or enclosed yards. It is proposed (by asphalt, concrete, or flagging) to render the ground surfaces practically impervious, so that they can be washed by a hose.

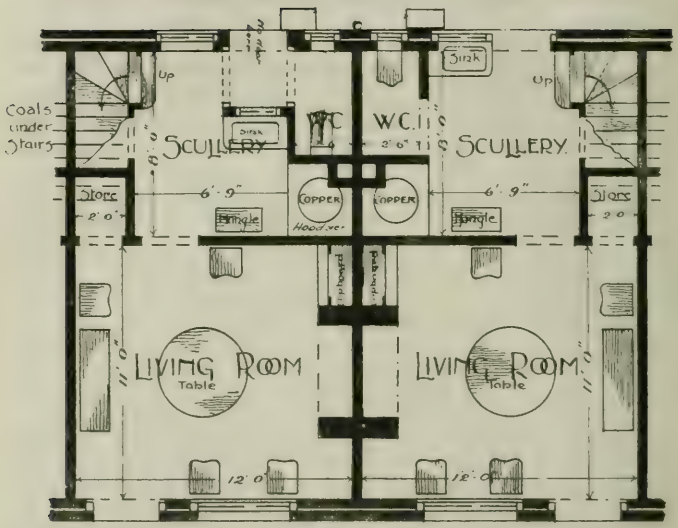
Each house occupies about fifty-one yards of land not including the front street.

The cost if twenty-four houses were built on the lines suggested need not exceed £80 per house. The following statement will give an approximate estimate of the cost and yearly revenue, if the scheme suggested were carried out without financial assistance from the local authority.

Expenditure.	£	*s.*	*d.*
5% interest on £80 and repayment of capital in 21 years	5	18	1
Ground rent	0	15	0
Repairs	0	10	0
Rates, 7/6 in the £ on a net assessment of £5/5/-	1	19	4½
Water	0	8	8
	£9	11	1½

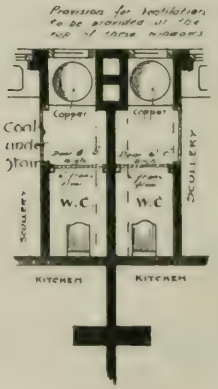
Receipts.	£	*s.*	*d.*
52 weeks' rent at 3/8 per week	9	10	8
To Balance	0	0	5½
	£9	11	1½

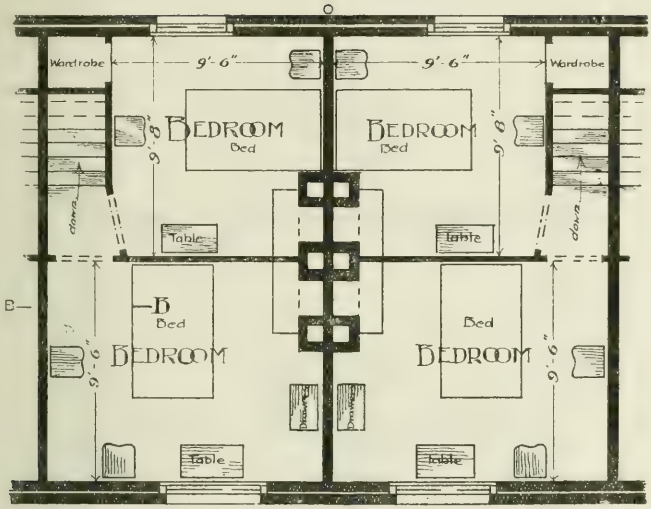
If the local authority would excuse the owner from payment of rates in special cases, the house could be let at a rent of 2s. 11d. per week. Houses of this class should not be let to those who have a reasonable income. The poor make their own appeal in this matter by their life. It is far better to remove the cause of the difficulty than to offer protection. Practice must take the place of charity; the danger to life and the suffering must be removed by the uplifting of those who are frail and indifferent to misery. Dealing with wounded humanity is not a pleasant occupation; but Mr. John Burns recently said that better housing conditions would do more good to the country and the town labourer than the distribution of millions of money in grants for the unemployed.



GROUND FLOOR PLAN.

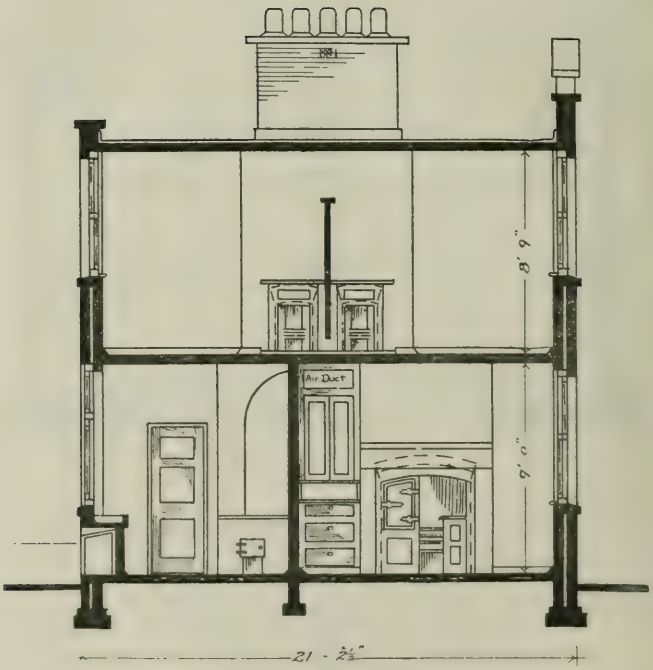
Alternative Arrangement for W.C. & COPPER.





FIRST FLOOR PLAN.

Section through B.B.



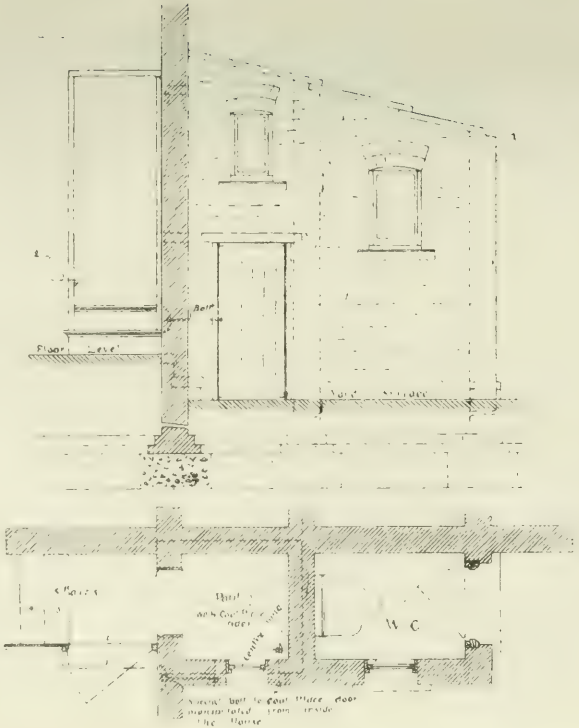
CROSS SECTION.

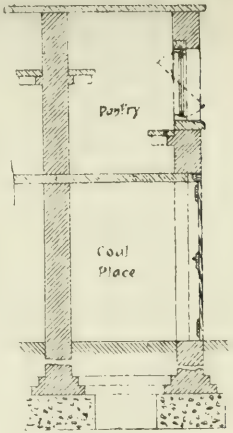
Mr. T. C. Horsfall (Macclesfield) said that however well-constructed small dwellings might be, they would not long continue to be wholesome, unless examined at frequent intervals by competent inspectors. Wherever careful examinations had been made of small dwellings, either in town or country, a large proportion had been found to have defects, causing injury to health, much of the cost of which had to be borne by the community. The existence of most of these defects was due more to ignorance than to desire to escape outlay, and it had been found in Bavaria and in Hessen, where a system of frequent inspection existed, that about eighty per cent. of the defects were removed, either by tenants or landlords, when the inspectors called attention to them. Legal coercion was needed in only a very small proportion of cases. In making plans for small dwellings it was necessary to remember that, although the dwellings must be small, as the future occupants could only pay low rents, the poor had as large natures as had rich people, and all their fundamental needs must be provided for in wholesome ways, either in their dwellings or in the near neighbourhood of the dwellings, or else the occupants of the small dwellings would find unwholesome ways of satisfying their needs, which would injure not only themselves but the whole community. The excessive drinking and betting in our manufacturing towns were, he believed, the inevitable result of leaving the towns unprovided with enough playgrounds, shrubberies, parks, tree-planted streets, and interesting buildings. The enlightened Oberbürgermeister of a German manufacturing town, Mannheim, had told his town council that it was the duty of the community to give compensation to those who must live in small dwellings by providing every part of the town with a sufficiency of promenades, playgrounds, etc. In order that no more dwellings might be built in the growing suburbs of their towns with environment as destitute of provision for the elementary needs of young and old as that of the dwellings in the central slum districts, Mr. Horsfall urged all to use any influence they possessed in getting the promised Town-planning Bill made as effective as possible.

Mr. J. Corbett (Salford) said there were so many considerations affecting this subject that it was impossible in a few minutes to even refer to them all, and so he proposed only to consider now what, in his opinion, should be the guiding principles in designing small dwellings for poor people. Firstly, as rich or poor were very much alike in their requirements, and as nearly all the people liked to imitate those they considered their betters in domestic arrangements and habits, he thought they should provide in the smallest separate dwellings the cheapest sound counterparts of the chief features of good small middle-class dwellings. Secondly, they must not strictly limit the cost of the small dwellings to match the cost of the existing dwellings in which the class of occupants were at present existing, as it was their duty to improve everything they could influence. Thirdly, as to the items of accommodation which, it seemed to him,

should always be provided in every small dwelling, he suggested as follows:—A reasonable sized living-room, seldom less than 150 square feet in area, with ample window light; ample through ventilation, by means of which the room could be thoroughly sweetened, after cooking the dinner, before sitting down to enjoy it. A good cooking-range, with an oven and some sort of boiler (he regretted that he could not yet advise that it should be a gas range, but that might soon be practicable). Several cupboards, including one specially ventilated to serve as a larder. A good gas or other light, and a top outlet-vent into the smoke flue, by a tube led down to the base of the flue, where there was no liability to back-draughts. A scullery, with sink, water-supply, washing boiler, good light, and thorough ventilation. A back-yard, with dust-bin and w.c. (he would absolutely prohibit the nasty economy of making one scullery or one w.c. serve more than one household.) In that short list they had all the essentials for a really cleanly, decent, and healthy life for a young or old couple, and he thought that some very small dwellings of this type should be provided in every community. The next step was to provide bed-rooms, other than the day-use living room. These could best be provided on an upper floor, should be as well lighted and ventilated as the day-room, and should provide at least 400 cubic feet of capacity for each adult or child using them. In every dwelling containing separate bed-rooms, a bath-room should be provided, as an economical and decent means of personal cleanliness, just as a scullery was usually provided for culinary cleanliness; and this bath-room should have a small bath, with hot and cold water supply, and preferably with a hot and cold shower rose, as this provided the cleanliest and most economical means of ablution. But in suggesting a bath-room, he owned that it was a luxury and not an essential of cleanliness, as he had known many people who managed to have a cold bath every morning and a hot wash once a week without a bath-room; just as he had known some people to smoke without a smoking-room. He did not like the suggestion often made that every dwelling should include three bed-rooms.

A plan is given showing a convenient arrangement of Pantry and Coal-place adopted in the Working-class Dwellings erected by the Salford Corporation.





Pantry and Coal-place as constructed at the Salford Corporation Working-class Dwellings.

NOTES ON LEGISLATION AND LAW CASES.

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SLAUGHTER-HOUSE. — *Licence — Condition Limitation of time — Less than twelve months — Invalidity — Public Health Acts Amendment Act, 1890 (53 & 54 Vict. c. 59), s. 29.*

By s. 29 of the Public Health Acts Amendment Act, 1890, licences for the use of places as slaughter-houses shall be in force for such time, not being less than twelve months, as the urban authority shall think fit to specify in such licences.

An urban authority granted to the appellant a licence, dated August 22, 1906, by which certain premises were licensed to be used as a slaughter-house "until December 31, 1906." Before December 31, 1906, the appellant applied for, but was refused, the renewal of the licence. The appellant was subsequently convicted for having used the premises as a slaughter-house on February 4, 1907, without having a licence in force:—

Held, that the conviction was wrong, for, there being no power to impose a condition limiting the duration of the licence to less than twelve months, the licence must be read as extended to August 22, 1907.

Taylor v. Winsford Urban District Council. Div. Ct., 3rd. 2 K.B. Dec., 1907.

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JOURNAL

OF

THE ROYAL SANITARY INSTITUTE

THE RELATIVE HYGIENIC VALUES OF GAS AND ELECTRIC LIGHTING.

By SAMUEL RIDEAL, D.Sc., F.I.C.

(FELLOW.)

Object of Investigation.

THE purpose of this inquiry has been to determine and compare the hygienic effects of gas and electricity as used for ordinary domestic lighting.

In addition to the direct physiological effects which the two lights, *qua* lights, might be expected to exert on those exposed to them, it was evident that account must also be taken of their indirect effects, through the changes which they might bring about in the air of the room in which they were used. The question to be solved, therefore, was whether any injurious physical and chemical changes in the air were *less* under one form of lighting than under the other; secondarily to look for any direct results from the light itself.

Three parallel lines of research were thus inicated as requisite: the first, into the direct hygienic effect of the two lights, the second, into the indirect effect due to their products, and the third, into the nature, amount and distribution of those products.

It was recognised that to obtain the most accurate results each branch of work should be carried on independently of the others, under specially arranged conditions; and in particular that the best prospect of arriving at definite physiological results lay in experiments conducted in a strictly physiological manner. This, however, would have been inconsistent with the general scheme of the inquiry, namely, that the subject should be studied under conditions resembling as closely as possible those of every-day life. Such lack of strict scientific accuracy as this limitation involved

was off-set by the opportunities which the parallel scheme of investigation afforded of comparing and checking against each other the results obtained in each branch of work. It was therefore decided to carry on the three branches of the inquiry simultaneously, and subsequently, on the foundations thus laid, to proceed with a series of test and control experiments, each designed to elucidate a particular question arising out of the earlier work.

The amount of work to be done has been greatly increased through the lack of the data which might have been expected to exist on matters of such importance in relation to the public health. Thus, no reliable information could be found as to the ventilation of ordinary living rooms, though for factories and other large buildings such statistics are met with in abundance.

Again, physiological observations on persons in ordinary health and following their ordinary avocations appear only to have been made for special purposes, such as the determination of averages of height, rate of pulse, and the like: while other physiological work, although carried into almost every branch of possible inquiry, does not appear to have direct bearing on the present question. Much preliminary work was therefore necessitated which would have been saved if authentic published data had been available.

The investigation being primarily a medical one, the physiological work has been given first place; the chemical and physical work having been for the most part confined to arranging and recording the conditions under which the medical observations have been made. The medical observations were made by Dr. Bertolacci, and the physical determinations by Mr. A. J. Martin, M.Inst. C.E., and I have to thank both of these colleagues and my staff generally for the assistance which they have afforded me in carrying out this investigation.

Physiological Observations.

The physiological observations were made on 15 persons; of these, 9 were assisting in the experiments, while 6 were clerks who attended after the room was divided, as subjects for observation only.

Of the first mentioned, one was a civil engineer, another a draughtsman, another a clerk and typist, and the rest were either analytical chemists, or laboratory assistants. The eldest was 42 years of age and the youngest 20, while their averages work out to 25·9 years each. The heaviest man weighed 140·3 lbs. while the lightest was 109 lbs., the average weight for each being 131·4 lbs.

A general medical examination of each man was made, and a careful record has been kept of the family and personal history and habits. None were accepted for the work except those who could give a good account of themselves in these respects. Their hearts and lungs were examined, besides which the urine in each case was tested to ascertain that there was no renal disease.

With regard to the clerks who attended as subjects during the latter part of the investigation, the eldest was 29 and the youngest 23 years, while their average would be represented by 25·25 years. The heaviest man weighed 148·75 lbs., the lightest 122·6 lbs., and the average weight for each man was 138·8 lbs. Although a less minute medical examination was made in these cases than in the former, their hearts and lungs were stethoscopically examined and inquiry was made as to any illness from which each man had suffered, sufficient to prove that all were healthy and could be classed with the other subjects as being fair physiological examples of men living and working in London.

Every man had a meal from half to three-quarters of an hour before attending. No drinking or smoking was permitted during the time they were under observation, and every care was taken to exclude those who had transient catarrhal or other symptoms which were likely to affect the results of the experiments.

The physiological data collected are very numerous and include observations on the—

Frequency of pulse and its character as shown by the sphygmograph.
Frequency of respiration.
Arterial blood pressures.
Variation in the number of blood corpuscles.
Body temperatures.
Body weights.
Mental fatigue.
Time reaction (mind and muscle).
Eye fatigues (differentiated).
Impressions on senses; and a
Special experiment on three subjects as to the poisonous effects of coal gas.

With the exception of the last mentioned experiment, which is complete in itself, care has been taken to collect and average the results so as to show any differences occurring under the two systems of lighting.

Place.

The work has been carried on in the basement of the office building, No. 28, Victoria Street, in two rooms known respectively as No. 4 and No. 6. The aspect of the rooms is about south-east by south, and the sun shines full on them during the later hours of the morning and the beginning of the afternoon. The floor of the rooms is 7 ft. 8 in. below the side walk, and the width of the intervening area is 8 ft.

The building consists of the basement, five stories and a mansard.

Dimensions.

The two rooms had previously been thrown into one, and the first series of experiments was carried on in the undivided room. In the beginning of March the two halves were separated by a wooden partition into two equal and symmetrical rooms, which were used separately for all subsequent work.

The undivided room was 29 ft. 9 in. long by 16 ft. 4½ in. wide and 10 ft. 4 in. high, and contained, allowing for chimney breasts, etc., 5,013 cubic feet. Each of the rooms as divided, is roughly square (16 ft. 4½ in. by 14 ft. 10 in.) In all calculations the capacity of the undivided room has been taken, in round numbers, at 5,000 c.f., no deduction being made for the space occupied by persons, furniture, etc.

A plan and section of the rooms are appended (Figs. 1 and 2).

Structural Features.

In the front wall (the only outer one) of each room there are two large windows, and in the opposite wall a door, giving access from the corridor and with a fanlight over it. By the side of the door in room 4 there is a large window, to give light to the corridor; but when the rooms were divided, this window was covered with a close screen, flush with the wall of the room, so as to preserve the symmetry of the two rooms. In the long wall of each room (being the end walls of the original room) there is a fireplace, and a door communicating with the room adjoining. These two doors have been blocked throughout the experiments.

Outside each door into the corridor a baize door has been hung, the intermediate space forming an air lock to minimise the disturbance of the air of the rooms by persons entering and leaving them. Each window has a holland blind, which was kept drawn down.

In the chimney of each room near the ceiling a ventilating grating has been built, the net area of the openings being 7 sq. in. Each grating is provided with mica flap valves and a sliding door, which was kept closed

FIG 1.

PLAN OF ROOMS

Scale of Feet

1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

FIG. 2

SECTION THROUGH ROOM

SECTION ON LINE X.X

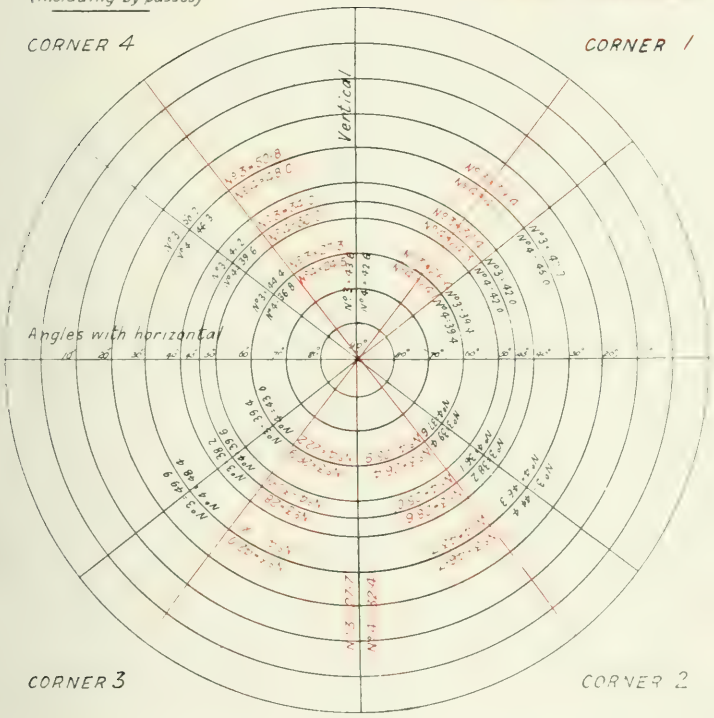
FIG. 3.

PHOTOMETRIC CHART.

Gas Tests in Black made 20th Feb. 1907.

Consumptions :–
N°3 Burner = 1·36 cu ft.
N°4 " = 1·18 "
(including by-passes)

Consumptions :-
N°3 Burner = 1·36 cu ft.
N°4 " = 1·18 "



erection of partition

during all but a few of the experiments, the fireplace also being blocked by a tight-fitting screen.

The floor is of wood in the form of planks nailed to sleepers which are bedded on concrete. It is covered with linoleum, over which felt is laid to within about a foot of the walls. The front wall is 1 ft. 11½ in. thick, and that against the corridor 1 ft. 8½ in., both being very solidly built of brickwork and cement. The room was distempered and whitewashed before taking possession on December 17th, by the workpeople of the Westminster Trust. When the work was completed it was ascertained that about 50 lbs. of whiting was used on the walls and ceilings, and this quantity was put on by the landlord, irrespective of any use to which the room was subsequently to be put, and can be said therefore to be the normal amount used by ordinary decorators in refitting rooms for a new period.

With the lighting at 4 c.f. of coal gas, and sulphur contents at a maximum of 60 grains per 100 c.f., there will be 2·4 grains of sulphur produced in the room per lighting hour, and a five hours' run per night will give a total daily evolution of 12 grains of sulphur.

Fifty pounds of whiting are equal to 350,000 grains, and as 100 grains of whiting combine with 32 grains of sulphur, the sulphur which the new whitewash is capable of fixing is equal to 112,000 grains, so that the room will remain basic, and therefore not require fresh whiting for 9,333 days, or say 25 years.

Lighting.

Each room can be lighted either by gas or electricity, and the consumption of both is recorded by fine reading meters in addition to the ordinary meters supplied by the companies. The scheme of lighting adopted has been that of an ordinary dining room, the lights having been disposed over a large central table, around which the subjects have sat. With a view to a fair comparison, the number, power and position of the lighting units has been as nearly as possible the same for gas and electricity, and the same for each room.

In the centre of each room was placed a brass pendant, having a hoop 2 ft. 1 in. in diameter and 4 in. deep, surrounded by a silk flounce, white inside and red out, and 12 in. deep. Each pendant is fitted with two gas and two electric lamps, placed alternately within the hoop in a circle 12 in. in diameter.

Gas Supply.

The gas used was the ordinary supply of the Gas Light and Coke Co. of 16 prescribed candle power. The price is 2s. 11d. per 1,000 c.f.

The ordinary pressure in the mains during the evening was 34 tenths of an inch, which was reduced by means of a governor to 19 tenths at the lamps.

The gas is officially tested each day for calorific power, the highest values recorded during the period covered by the experiments being 644 British thermal units gross and 578 B.T.U. net on January 18th: on two occasions the values fell to 582 B.T.U. and 519 B.T.U. respectively. The average values during the whole period were very close to 600 B.T.U. gross and 540 B.T.U. net, and these figures have been used in all general calculations. On any particular night, however, the observed value for that date has been taken.

The carbonic acid production per c.f. of coal-gas was determined each day by an explosion analysis and found to average 0·6 per c.f. of gas.

Similarly the amount of water produced by the gas was directly determined from the amount condensed in the calorimeter, allowance being made for that escaping as gas, and show an average of 395 grains of water produced per c.f. of gas. The figures for February are given in the table below.

TABLE *showing the amount of carbonic acid gas, water, and heat produced by burning coal gas.*

DATE. 1907.	PER CUBIC FOOT OF GAS.				PER HOUR.			
	CO_2 cubic feet.	Water Grains.	Calorific Value B.T. Units		Gas consumed cubic feet.	CO_2 produced cubic feet.	Water produced grains	Net Calorific Value B.T. Units
			Gross.	Net.				
Feb. 1	0·56	388	613·7	547·5	4·08	2·28	1583	2234
„ 11	0·54	386	596·4	531·4	4·16	2·24	1593	2210
„ 12	0·55	403	598·3	534·3	4·06	2·23	1636	2168
„ 13	0·63	408	602·3	538·8	3·96	2·49	1616	2133
„ 14	0·64	391	601·4	533·3	3·98	2·54	1233	2117
„ 15	0·59	391	601.4	534·0	3·97	2·34	1233	2120
„ 19	0·61	413	599·9	535·9	4·47	2·74	1846	2395
„ 23 and 25	0·64	401	591·0	530·9	4·06	2·98	1868	2474
„ 27	0.67	406	612·2	546·3	4·08	2·73	1656	2229

GAS BURNERS.

The gas burners were of the Darwin Bijou inverted incandescent type, of 25 nominal candle power, consuming on the average about 1·28 c.f. per hour. Each burner was furnished with a by-pass, and the two burners in each pendant were controlled by a pneumatic switch at the door.

At the outset a difficulty was experienced with the gas-burners in room 4, in their sensitiveness to slight vibrations, such as the click of a

typewriter or the musical note made by tapping the neck of a flask. The burners in room 6 were much less sensitive to influences of the kind. The first governor put in proved too large to regulate the small flow of gas to the lamps, and in its efforts to do so set up oscillations which caused the flames to flicker violently and continuously. These initial troubles having been got over with the gas-lamps, they become very steady and satisfactory in all respects.

ELECTRIC SUPPLY.

The current used for the electric lighting was supplied by the Westminster Electric Supply Corporation at a pressure of 200 volts. The ordinary price is 5½d. per Board of Trade unit (kw. hour).

GLOW LAMPS.

The lamps were "Royal Ediswan" glow lamps of 25 nominal candle-power. The average consumption of current was about 94 watts per lamp.

EFFICIENCY AND LIFE OF INCANDESCENT LAMPS.

The candle-power obtained depends on the pressure at which the electric current is supplied. A rise in the voltage produces in the first instance a proportionate increase in the current taken by the lamp. The larger current raises the temperature of the filament, the resistance of which is thereby lowered. This results in a further increase in the current passing, the variation in which is consequently somewhat greater than that in the voltage.

The watts consumed are equal to the product of the volts by the amperes. If the latter were proportional to the former, the watts would vary as the square of the volts, but, owing to the lowering of the resistance above referred to, the watts increase somewhat faster than the square of the voltage.

Practically the whole of the energy supplied to the lamp is converted into heat, the generation of which also increases somewhat faster than the square of the voltage.

The temperature of the filament was recently given by Hadfield as 1,800° C. or 3272° F.

The light emitted depends on the temperature obtained, and is stated to vary approximately as $V^{5\cdot5}$, V being the voltage.

H. A. Clark* has shown that the variation in candle-power with change in the voltage is considerable. Thus a 16-c.p. lamp, when running under two-thirds of its normal pressure, and taking 40 per cent. of its

* H. A. Clark, in Fowler's "Mechanical Engineers' Pocket-book."

normal energy, gave practically no light, while an excess of 13½ per cent. in the voltage and 37 per cent. in the watts raised the candle-power nearly 140 per cent. above the normal, with an increase in efficiency of 73 per cent.

The voltage of the Westminster supply is said to be liable to vary from 197 to 205 volts, giving a range of 8 volts, or 4 per cent. The resultant variation in candle-power is from 23 c.p. to 30½ c.p., showing a difference of 7½ c.p., or 30 per cent. The watts per candle range from 3·4 at the lower voltage to 2·86 at the higher. The lamps used were very steady throughout the inquiry.

It will be seen from the foregoing that an increase in voltage is accompanied by a very considerable gain in efficiency, but this gain is only realised at the expense of a serious falling-off in the life of the lamp. Thus, experiments have shown that a lamp which, at its normal pressure of 100 volts, has a life of 1,000 hours, lasts under 105 volts only about 250 hours. This consideration will generally render it advisable to run lamps well under their maximum efficiency.

Neither the efficiency nor the candle-power of a lamp remains constant, both showing a progressive falling-off during the period of use. It is therefore not usually economical to use a lamp longer than from 450 to 500 hours.*

It seems established that the deterioration in the efficiency of a lamp would be more rapid if the voltage were variable, especially if the standard voltage were exceeded.†

Photometric Observations.

Photometric observations were made in the rooms on Jan. 4th and 10th, Feb. 20th, March 13th, and April 8th. The instrument used was one of Simmance and Abady's flicker photometers. Each lamp was tested separately in position, with the flounce hanging behind it. The values obtained denote, therefore, not the power of the naked lamp, but its actual illuminating effect under the conditions in which it was used. Measurements were taken immediately under each lamp and at angles of 60°, 45°, and 30° from the horizontal from each of the four corners of the room. The chart (Fig. 3, p. 53) shows the manner in which the results were recorded, the black figures referring to the gas and the red to the electric lamps.

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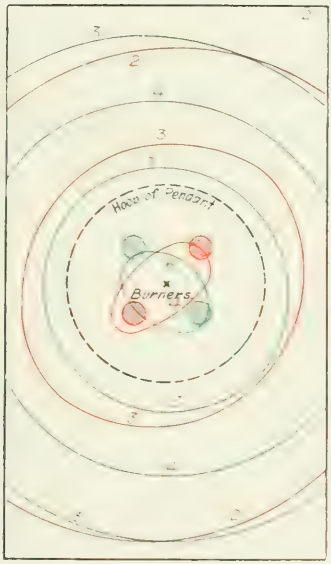
* F. C. Bailey, Cincinnati. *Proc. Inst. C.E.*, Vol. CLI., p. 522.

† Sir W. Preece, *Brit. Ass. Reports*, 1906.

ILLUMINATION OF TABLE.

In Candles at one foot distance.



Green curves show illumination by Gas (Tests made 20th Feb 1907.)
Red " " " " Electricity. Tests made 6th Mar. 1907.

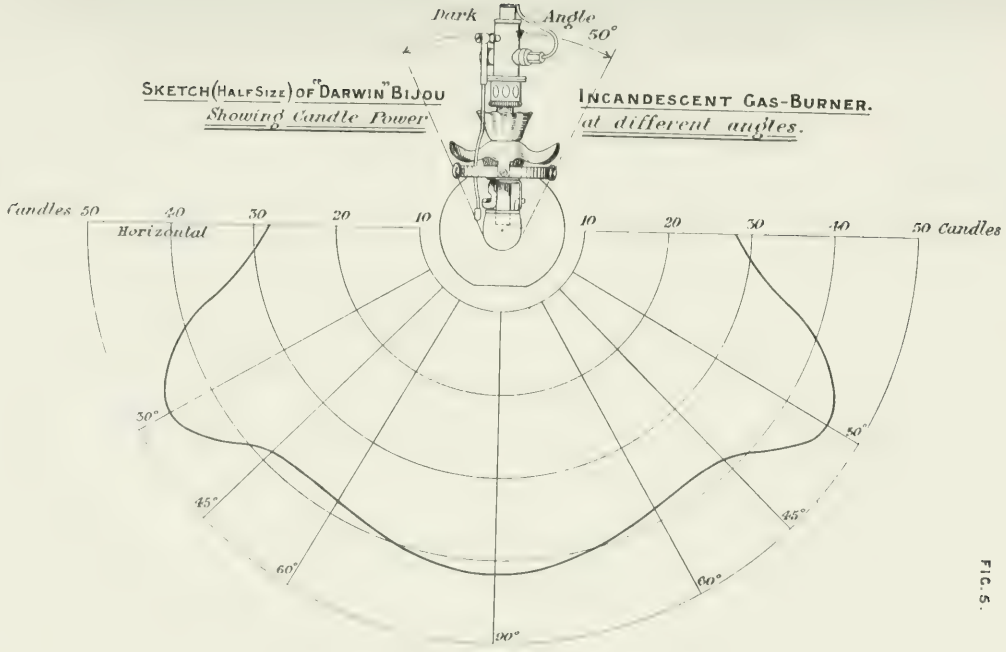

Park
Angle
50°
SKETCH (HALF SIZE) OF "DARWIN" BIJOU
Showing Candle Power
INCANDESCENT GAS-BURNER.
at different angles.
Candles 50 40 30 20 10
Horizontal
10 20 30 40 50 Candles
30°
45°
60°
90°
50°
45°
60°

FIG. 5.

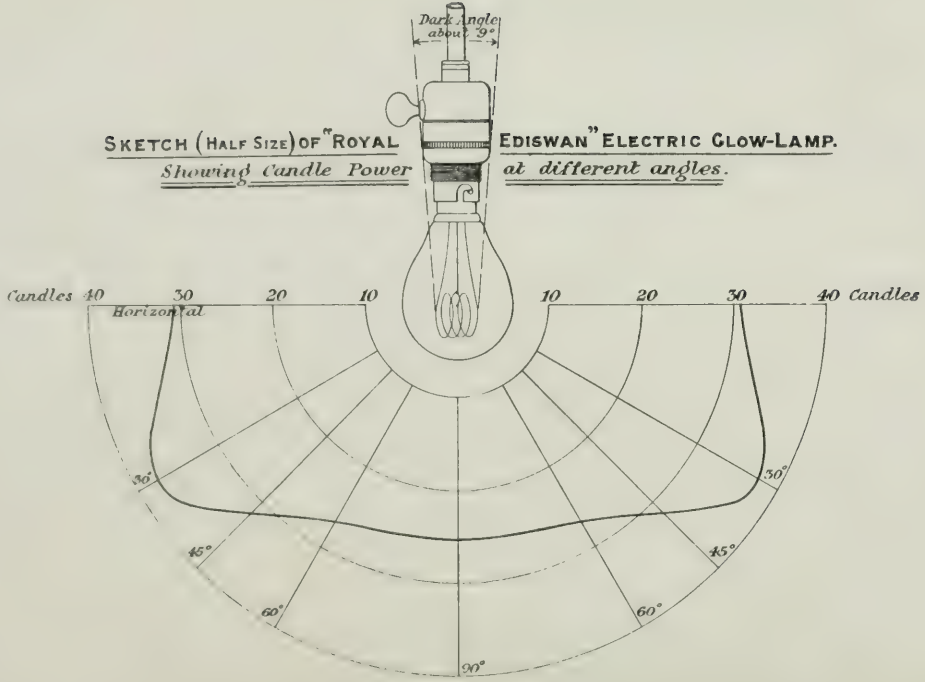

Dark Angle about 29°
SKETCH (HALF SIZE) OF "ROYAL EDISWAN" ELECTRIC GLOW-LAMP.
Showing Candle Power at different angles.
Candles 40 30 20 10 10 20 30 40 Candles
Horizontal
30°
45°
60°
90°
30°
45°
60°

FIG. 6.

The hemispherical intensities of the various gas and electric units were as follows :—

	Gas Burners.				Electric Lamps.			
	Room 4.		Room 6.		Room 4.		Room 6.	
Burner.	1	2	3	4	1	2	3	4
Jan. 4 & 10 ...	41·6	31·3	40·4	39·6	37·3	34·9	38·0	41·4
Feb. 20	38·9	33·5	39·9	39·0	...	...	...	...
Mar. 6.....	...	...	...	...	27·4	29·0	34·0	34·2
Mar. 13	29·0	38·7	40·8	34·4	...	...	...	...
Apr. 8.....	...	...	...	...	33·4	27·7	27·6	28·0
Average	39·8	34·5	40·4	37·7	32·7	30·5	33·2	34·5
Average of all	38·1				32·7			

The following were the yields of light per c.f. of gas and per 100 watts respectively :—

	Gas Burners.				Electric Lamps.			
	Room 4.		Room 6.		Room 4.		Room 6.	
Burner.	1	2	3	4	1	2	3	4
Feb. 20	33·0	27·9	29·3	33·0	...	...	...	...
Mar. 6.....	...	...	...	...	33·4	33·6	37·5	30·1
Mar. 13	29·6	27·3	30·2	24·0	...	...	...	...
Apr. 8.....	...	...	...	...	33·9	30·0	29·8	26·4
Average	31·3	27·6	29·75	28·5	33·65	31·8	33·65	28·25
Average of all	29·3				31·8			

These figures show an apparent falling-off in efficiency of 13·3 per cent. in the case of gas and 14·5 per cent. for electricity. Other tests, made under conditions more favourable for accurate photometric work, give somewhat different results. Thus a mantle, similar in all respects to those used in the experiments, was tested for durability at No. 7, Tudor St., Blackfriars, on a continuous run of 603 hours, the consumption of gas averaging as above, 1·28 c.f.hr. The average horizontal illuminating value was 28·1 c.p., equal to 22 c.p. per cubic foot of gas per hour. During the first 400 hours the candle-power per c.f.hr. remained practically steady at 22·5 ; at the end of the 603 hours it had fallen to 20·1.

The electric lamps were removed from the pendants at the close of the experiments, and tested horizontally. The average horizontal candle-

power of the four lamps was 27·8, measured in the plane of the filament rings, and 33·6 in the axes of the rings, giving a mean of 30·7 c.p. The average consumption of current was therefore 3·06 watts per candle (horizontal) corresponding to an efficiency of 0·327 candles per watt. A new lamp, similar to these four, gave 26·1 c.p. when tested with the edges of the rings to the photometer, 24·5 c.p. when turned at right angles, and an average of 25·3. The new lamp was thus inferior to those which had been in use, and the mean horizontal candle-power of the gas burners was midway between those of the old and the new electric lamps.

Illumination.

The illumination obtained from each pair of lamps, on the table 3 ft. 7½ in. below them, varied (for gas) from the equivalent of 6·1 candles at 1 ft. distance in the centre to about 2 candles at the corners of the table, the size of which was 6 ft. by 3 ft. 6 in. The electric illumination ranged from 4·2 candles at the centre to 1·5 candles at the corners. A diagram is appended showing the distribution of light on the table in Room 6, as measured on February 20th and March 6th. (Fig. 4, p. 56.)

It will be seen that the gas burners threw considerably more light on the table than the electric lamps. The latter, on the other hand, gave a better illumination in the body of the room, this superiority being particularly noticeable in reading the thermometers and the carbonic acid apparatus. The difference in the distribution of the light from the two types of lamp was due to differences in their form and in the disposition of the luminous surfaces, the broad metal mountings of the inverted gas burners intercepting most of the light which would otherwise have passed upwards, while the electric filaments were free to radiate in all directions except vertically upwards. This is clearly shown by the sketches of the two lamps. (Figs. 5 and 6, p. 56.) It is of course possible for electric lamps to be so shaded as to give a high percentage of downward illumination, as obtains in an inverted gas burner.

Heating.

As a general rule the rooms were not heated, except by the lamps and the inmates themselves, but during the latter part of January the weather became so cold as to necessitate some means of warming. A coal or gas fire would have been out of the question, as destroying the control which it was desired to exercise on the ventilation. An electric heater was accordingly put in, the dark type being selected in order that the lighting of the rooms might not be interfered with. Current for the purpose was

supplied through a separate meter, at a cost of one penny per unit, the consumption being about one unit per hour. After the room was divided, a second heater of about the same capacity was installed.

ARRANGEMENT OF WORK.

Down to the end of February all the experiments were carried on in the undivided room, the illumination being varied from night to night, or in some cases from week to week. After the rooms were separated, gas was generally used in one room and electricity in the other, the two illuminants being alternated from room to room in order to neutralise any difference which there might be in the characteristics of the two rooms. In addition to the medical observations the following physical and chemical work was carried on.

The air supply was generally measured before and after each evening's run.

The temperature at various points in the room, and the difference between the dry bulb and wet bulb thermometers were noted, as a rule, every half-hour.

The proportion of carbonic acid gas in the air was measured at short intervals, generally from ten to twenty minutes. In addition, the organic matter and the carbon monoxide present was determined from time to time, and the bacteriological contents of the air under the various experimental conditions was also specially investigated.

The temperature of the corridor and the outer air, the readings of the gas and the electric meters, and the gas pressures were noted before and after each evening's work.

METEOROLOGICAL RECORD.

A record was also kept of the meteorological conditions, as reported by the Meteorological Office; the readings of the dry and wet bulb thermometers in St. James's Park and the churchyard in Victoria Street, by the Windsor Hotel, being specially supplied by the Office.

TABLES OF RESULTS.

A consecutive summary of each day's observations was prepared in tabular form and supplementary tables were added, bringing together the results for those days on which identical conditions were maintained. These results are dealt with in their respective sections, but their general character will be apparent from the following abstract.

Classified Summary of Observations.

Room.	Illuminant.	Number of Hours.	Max. number of people.	Air supply c.f. per hr.	Max CO_2 parts in 10,000	Temperature.			Percentage humidity.		
						Start.	Finish.	Change.	Start.	Finish.	Change.
Undivided....	Gas...	22	8·4	{ 3,525 * / 7,895 † }	{ 30·1 / 14·9 }	53·6°	57·0°	+3·4°	74·2	76·8	+2·6
„ ...	Elec.	19	8·4	{ 3,355 * / 7,191 † }	{ 23·0 / 12·9 }	54·0°	57·2°	+3·2°	73·7	76·0	+2·3
Divided ...	Gas...	15	7·5	{ 2,045 * / 11,300 † }	{ 37·2 / 12·8 }	60·9°	64·0°	+3·1°	69·1	70·4	+1·3
„ ..	Elec.	15	7·5	{ 1,961 * / 11,200 † }	{ 29·9 / 12·3 }	60·5°	63·3°	+2·8°	71·1	71·9	+0·8

* Restricted ventilation (fireplaces and ventilators closed).
† Natural ventilation (fireplaces and ventilators open).

On some occasions in the divided rooms the windows and doors were also open.

For reasons given on page 70 the higher ventilation figures must be regarded as approximations only.

General Observation on Results.

In order to ascertain the influence of the two modes of lighting on health, it was first necessary to determine the mode in which these effects are occasioned, and especially the influence of the products of the illuminants.

Light from gas combustion is accompanied by heat, water vapour, carbonic acid and other products. In ordinary indoor electric lighting, as there is no combustion, chemical products are absent, and this is often claimed as establishing the hygienic superiority of electricity. Gas, on the other hand, is said to poison the air with CO_2 and other products of combustion, to heat it to an undesirable extent, to dry it, or (alternatively) to overload it with moisture.

Ultimately the hygienic effects of the two modes of lighting must be a medical question, but their causation involves a consideration of the physical and chemical conditions.

Quantities of the Products Generated by Gas Combustion.

Heat.—The 25 c.p. gas burners each consumed on an average 1·28 c.f. per hour or 2·56 c.f. hour per pair. The average calorific value of the gas used was about 600 B.T.U. (gross) and 540 B.T.U. (net). The lower

figure is the only one of importance in this inquiry, since the 60 units expended in the vaporisation of water are not recovered within the room. The net heat obtained from 2·56 c.f. of gas is therefore 1,382 B.T.U.

Moisture.—Each c.f. of gas gave as an average 295 grains of water; 2·56 c.f. therefore yield 1,012 grains.

Carbonic Acid.—The CO_2 formed per c.f. of gas averaged 0·6; the two burners, consuming 2·56 c.f. of gas, produced 1·54 c.f. of CO_2.

HEAT FROM ELECTRICITY.

Each 25 c.p. glow lamp consumed on an average 94 watts, or 188 watts for the pair. The heat equivalent of one watt is 3·435 B.T.U. per hour, and that of 188 watts = 658 B.T.U. per hour.

It is often assumed that a glow lamp gives off practically no heat: but it will be seen from the foregoing that for an equal illumination the yield of heat by electricity is close on one-half that of gas.

PRODUCTS OF RESPIRATION.

In a gas-lighted room the gas is not the only source of heat, moisture, or carbonic acid gas, all of which, in appreciable quantities, are given off by the skin and lungs of the inmates of the room. The published estimates of the human output of moisture and carbonic acid differ widely, but the present experiments have incidentally furnished some data concerning them.

Carbonic Acid.—The CO_2 determinations, taken in conjunction with the volume of air entering and leaving the room, indicate a human production of this gas approaching eight-tenths of a c.f. per hour. (See page 71.)

Moisture.—Before January 24th, each subject was weighed at the beginning and end of each evening's run, the average loss of weight in 77 cases over periods ranging from two and two-thirds to four-and-a-half hours being 0·113 pound per man per hour. This mostly represents water evaporated from the skin and lungs, the output of CO_2 being loss on the exchange of these gases leaves 0·104 lb. as each man's hourly nearly balanced by the oxygen taken into the body. Allowing for the output of water vapour, equal to 2½ lbs. per day, or about the mean of the figures which have been published. Expressing the result in grains, we have in round numbers 700 grains of water per man per hour.

Heat.—Information as to the amount of heat generated in the body is scanty. Dr. Gordon, in his report on the ventilation of the House of Commons, issued in 1906, quotes an estimate by Rubner amounting to

2,700 (large) calories per adult man per day, equivalent to 446·4 B.T.U. (gross) per hour. Nearly a quarter of this (107·5 B.T.U.) is expended in evaporating the above-mentioned tenth of a pound of water, leaving 338·9 B.T.U. (or say 340 B.T.U.) as the net calorific value of an adult man.* The human production of heat is thus equal to about a half of that of a 25 c.p. Darwin gas-burner, and slightly more than that from an electric glow lamp of the same power.

In an ordinary dining-room of the size of those now in question, there would often be as many as six men at a time. The yields of heat, moisture, and CO_2 from two burners and six men respectively are set out in the following table :—

Hourly Production of	Two 25 c.p. Electric Lamps.	Two 25 c.p. Gas Lamps.	Six Men.
Heat in B.T.U.	658	1,382	2,040
Moisture in grains	—	1,012	4,200
CO_2 in c.f.	—	1·54	4.8

The next table shows the changes which these quantities would bring about in one hour in the temperature and composition of the air of the room, the capacity being taken at 2,500 c.f., the initial temperature at 40° F., the humidity 69 per cent. (corresponding to ·21 gr. of water per c.f.), and the carbonic acid at the ordinary figure for town air, viz., 4 parts in 10,000.

	Two 25 c.p. Electric Lamps.	Two 25 c.p. Gas Lamps.	Six Men.
Rise in temperature	13·9° F.	29·1°F.	43°F.
Final temperature	53·9°	69·1°	85°
Added moisture, grn. per c.f.	0	0·4	1·68
Final humidity at raised temperature	43 per cent.	31 per cent.	31 per cent.
Added CO_2 pts. in 10,000	—	6·2	19·2
Final CO_2 ditto	—	10·2	23·2

It will be seen that the alterations brought about in the air of the room by the human contributions far exceed those from either illuminant. The figures assume that the air of the room is stationary: in actual experience the variation is much less, on account of ventilation. With an air supply equal to three times the contents of the room, which may be

* Benedict and Miller from their respiration calorimeter experiments show that a man at rest evolves from 258 B.T.U. per hour when sleeping, to 397 B.T.U. when sitting up. *U. S. Board of Agriculture Reports.*

taken as a measurable maximum, the changes would be proportionably smaller, the increase in the CO_2 becoming 2·1 and 6·4 parts from gas-burners and men respectively.

Air consumed.—Gas differs from electricity in requiring a certain amount of air to support combustion. A c.f. of the gas used in these experiments consumes about 1·2 c.f. of oxygen, representing about 5·7 c.f. of air. Two burners, therefore, using together 2·56 c.f. of gas per hour, require 14·6 c.f. of air. The average amount of air admitted per hour to each of the divided rooms, with the restricted ventilation adopted, was 2,000 c.f., of which the gas-burners consume just 0·73 per cent. The consequent reduction in the amount of oxygen in the room is precisely the same as would result from a fall in the barometer from 30 in. to 29·78 in.

Each man consumes about 1 c.f. of oxygen per hour, representing 4·8 c.f. of air, or two-thirds of the quantity required by each gas-burner.

Carbonic Acid.

Modes of sampling air.—In order to obtain average samples of the room air, a ring of tubing was laid along the walls 3½ ft. from the floor, with branches of indiarubber tubing ending in perforated plugs, which could be fixed in any desired position. A small enclosed electric fan connected with the main pipe drew air simultaneously and in equal quantities through all the inlets. It was discovered, however, later that samples could be taken at a single point, which, if not absolutely identical with the average of the room, were proportional to it and sufficiently near for all purposes of the investigation. A glass tube was, therefore, placed in a convenient position near the centre of the room about 6½ ft. above the floor, and connected with a small pump, worked by a water-jet, whereby a constant current of air could be drawn through it.

The determination of carbon dioxide.—The most accurate results are obtained by the use of large volumes of air drawn for a considerable length of time through appropriate absorption reagents. Such a method was obviously excluded in the present case, since the samples had to be collected as rapidly as possible on a time basis, and Haldane's instrument, which admirably fulfils this condition, was, therefore, used throughout. After the observer had got accustomed to his instrument it was found that the average error of a single reading was ± 0·5 part per 10,000. Duplicates on outside air would frequently agree to 0·2 part per 10,000, but on the other hand, readings would occasionally vary without assignable cause by more than 1 part per 10,000.

Numerous measurements were made as a check with an absolute

baryta method, Hesse's modification of the original process of Pettenkofer being adopted. The average error of this was ± 0·1 part per 10,000 less than with the Haldane instrument, but this increased accuracy was more than neutralised, in the measurement of a rapidly falling carbonic acid content, when determining the ventilation, by the time required to take a sample, having regard to the necessity for the complete displacement of the air in the flask.

In other words, the value of each estimation then depends on two measurements, carbon dioxide and time, and it is useless to increase the accuracy with which the first is determined, if thereby an increased error is introduced into the time measurement. (*See* VENTILATION. p. 66.)

It will be seen from the general tables that the occasions were rare on which the CO_2 did not reach 10 parts in 10,000, that it more often ranged between 20 and 30 parts, and that on two evenings (March 20th and 21st) figures exceeding 50 were attained.

Hygienic Significance of Carbonic Acid.—The objection which is raised on hygienic grounds to lighting by means of gas is centred on the production of carbonic acid gas, which it is common to describe as a poison. It will be well to inquire what this means.

To begin with, CO_2 is a necessary constituent of the atmosphere, in which it is invariably present in the proportion of at least about 3 parts in every 10,000. If then it is a poison it follows that the purest air is poisoned to this extent. It is true that no man or other animal could exist in an atmosphere of CO_2, but an atmosphere of nitrogen or even oxygen would be equally fatal; no one, however, speaks of these gases as poisonous. It is true also that a very large increase in the proportion of CO_2 in the air would produce unpleasant, or even fatal effects, but the same holds good of any of its other constituents.

The question, therefore, resolves itself into one of amount,—in what proportion can CO_2 be added to the air without producing untoward results? This gas is used for aërating mineral waters, and is present in the air of the factories where they are made in very large quantities ranging up to 300 parts in 10,000. If the proportion reaches 500 parts (5 per cent.) it induces sickness or even death. In this connection it is important to note that the air expired from the lungs contains on an average 4·3 per cent. of CO_2. It is not surprising that an atmosphere which approaches in composition the air which is ordinarily ejected from the lungs should be unsuitable for human respiration.

Under the extreme conditions which were maintained for the purpose of the experiment, the CO_2 figure rose as high as 53·2 parts in 10,000 on

one occasion, and frequently was over 40 without becoming apparent to the senses or in any way affecting the health of those present. On many occasions the high figures were reached in electric-lighted rooms, so that the carbonic acid was entirely of human origin. It would be a very poorly ventilated room in which even 20 parts in 10,000 would be found.

Dr. Angus Smith found that 300 volumes CO_2 per 10,000 of air produced feebleness of circulation, slowed the heart and quickened respiration, but felt no inconvenience with 20 in 10,000. Pettenkofer and Voit, after long exposure to air containing 100 in 10,000, found *no* discomfort.

Wilson, on the other hand, states that when CO_2 is produced *from persons* and the amount reaches 15 per 10,000 in the air, headache is often produced, but he does not take into account any other factors.

Claude Bernard considered CO_2 non-poisonous, as it could be injected into the bodies of animals without causing injury, and that it is purely negative in action.

Herman has definitely proved that increase of carbon dioxide up to 4 per cent., and a reduction of oxygen down to 15 per cent., do not produce any poisonous action in human beings.

Benedict and Milner quite recently, in an investigation on metabolism of matter and energy in the human body (*U.S. Board of Agriculture Reports*), have established that a subject in a respiration calorimeter can read, sleep and eat meals with the usual regularity and show no deviation from his usual physical and mental condition in an atmosphere containing 226 per 10,000 (2·3 per cent.) of CO_2.

The harmlessness of carbonic acid gas in the largest quantities which are liable to occur is freely recognised by medical men and others who have dealt with the subject, and it is now acknowledged that the ill effects popularly attributed to this gas are actually due to entirely different causes. Thus the "Black Hole of Calcutta" is quoted by Dr. Billings as "an extreme instance of the co-existence of high temperature and excess of moisture in the air of an enclosed apartment." ("Ventilation and Heat," p. 66; see also Haldane and Lorrain Smith, J. Path., Edin., 1892).

Why, then, has so much stress been laid on the amount of CO_2 in air? It is because this gas, though innocuous in itself, is often associated with other substances of a more or less harmful nature. As a product of respiration it is accompanied by a certain amount of organic matter more or less offensive, and even by infective material and the germs of disease. The liability to convey disease germs is shared by many other substances, milk for example, which it is not customary to describe as poisonous. It may be guarded against by sterilising the substance, in the case of milk

by boiling it. The CO_2 from gas is necessarily sterile, and from a health point of view bears the same relation to that of respiratory origin as sterilised milk does to the unsterilised product.

The worst that can be said even of respiratory CO_2 is that it is often found in bad company, and, as in other cases of the kind, it is made the scapegoat for the real culprits, which it is not always easy to identify. As an *indicator* of the amount of respiratory pollution, CO_2 determinations will always be valuable, but it would be as absurd to compare the indicator with the obnoxious matter which it indicates, as it would be to regard the high chloride, which leads the chemist to suspect a drinking water of being contaminated with sewage, as the real polluting matter. They are both indicators, and nothing more.

The importance of the distinction between the CO_2 from gas and that of respiratory origin is clearly recognised by the Departmental Committee on Ventilation in Factories, who, while recommending a maximum limit of 12 parts of CO_2 in 10,000 in the day time, when the excess above that found in outer air is wholly or chiefly due to respiration, allow 20 parts after dark in places where gas or oil (but not electricity) is used for illuminating purposes.

Ventilation.

In considering the question of air contamination, there is a tendency to assume that the longer a room is in use the fouler the air will become. This is only partially true. It would hold good absolutely if the room were like a stagnant pond in which the effete matters accumulated to an indefinite extent. But no room is or can be like this; it is more analogous to a lake through which a river flows, changing its contents slowly and continuously. If such a lake receives a polluting liquid it will be seen at once that the extent of the contamination depends, not on the size of the lake, but on the proportion which the polluting flow bears to the volume of the river. Exactly the same thing will occur in the case of a room. The state of the air will depend, not on the size of the room, but solely on the ratio of the contamination to the incoming air. Since the matters which pollute air are not all readily measurable, it will be convenient to deal with a gas, such as CO_2, the proportion of which can be exactly determined. Take the case of a room containing 2,500 c.f., in which there are six men, and two gas burners, producing respectively 4·8 c.f. hour, and 1·6 c.f. hour of CO_2, 6·4 c.f. hour in all. If the air supply is 3,200 c.f. hour, the excess of the CO_2 which the outgoing air will contain as compared with incoming air will be $\frac{6.4 \times 10,000}{3,200} = 20$ parts in 10,000. If 6,400 c.f.

are admitted every hour, the proportion will be 10 in 10,000 and so on. This is the ultimate or steady state of the air, and is independent of the size of the room, which is only important as determining the length of time required to arrive at the steady state. It is difficult to follow the change in composition if the CO_2 is regarded as added to the air of the room, but the difficulty disappears if we remember that the production of this gas and the admission of fresh air go on concurrently, and if we take the two in conjunction. Every c.f. of air that enters the room may be regarded as carrying its quota of CO_2 and displacing 1 c.f. of the old air. In most cases, especially in air filtering through the walls, it will not be far wrong to assume that the incoming air mingles fairly uniformly with that already in the room. Thus, when the first foot has passed in, the room contains $\frac{1}{2,500}$ part of new air and $\frac{2,499}{2,500}$ parts of old air. The second foot of new air displaces $\frac{1}{2,500}$ of each of these, and leaves $\frac{2,499}{2,500}$ of each. Therefore, when 2 c.f. have passed in, there remains of the old air $\frac{2,499}{2,500} \times \frac{2,499}{2,500}$ parts, or $\left(\frac{2,499}{2,500}\right)^2$. Similarly after 3 c.f. have entered there will be $\left(\frac{2,499}{2,500}\right)^3$ parts of the old air, and after n c.f. $\left(\frac{2,499}{2,500}\right)^n$ parts. The calculation on these lines is an exceedingly simple one. It is merely necessary to multiply the logarithm of $\frac{2,499}{2,500}$ by the number of c.f. of air admitted to the room in the period in question, and the product will be the logarithm of the proportion of old air which remains. The balance will, of course, be new air, containing its proportion of CO_2, and by spreading the latter over the whole contents of the room the percentage of this gas will be obtained. The change in the composition of the air of the room which results from the admission of varying volumes of new air is shown by the following table:—

New air admitted.....	2,500	5,000	7,500	10,000	12,500	15,000
= Contents of room...	1	2	3	4	5	6
Percentage old air left	36·8	13·5	5·0	1·8	·7	·25
„ new air ...	63·2	86·5	95·0	98·2	99·3	99·75

It will be seen that when the quantity of air admitted reaches three times the contents of the room only 5 per cent. of the old air will remain, and that when six volumes have passed through the change in the composition of the air of the room will be practically complete. Thus, with an air supply of 7,500 c. f. per hour, a single hour will suffice to bring the room within 5 per cent. of the steady state.

Ventilation is brought about by a variety of causes, of which the chief are the wind and the difference of temperature inside and out. A fire

burning under a chimney, or a gas cluster under a shaft, creates a powerful draught, and a gas burner, even when provided with no special outlet, sets up currents which stimulate the ventilation.

The measurement of large flows of air is always a difficult problem, especially in the case of ventilation, where the flow takes place not only through definite openings such as doors and windows, but also by the chinks around them, and even through the substance of the walls and ceiling.

In order to make sure of detecting the differences between the results of the two methods of lighting, it was decided to restrict the ventilation, and thus, by concentrating the products, to magnify their effects. Hence the closing of ventilators and fireplaces and the intercepting baize doors already referred to.

In such a case mechanical modes of measurement are out of the question. It was therefore decided to introduce into the room a large quantity of carbonic acid gas, mix it thoroughly, and then at short intervals determine the proportion present. One or two trials were made as described by Pettenkofer, by burning a number of candles in the room, weighing them, calculating the amount of CO_2 produced, and determining the proportion of the latter in the room atmosphere. As compared with the original or "fall" method this process has the disadvantages of being much slower and less accurate, and of involving a somewhat intricate calculation. The fall method was accordingly reverted to, and was used for the majority of the determinations.

Carbon dioxide was introduced from a cylinder of the liquefied gas, following the suggestion of Petri (*Zeits. f. Hyg.*, Bd. VI.), and thoroughly mixed with the air of the room by means of an electric fan. The room was then closed, allowed to stand for at least thirty minutes, and samples drawn out at regular intervals of time through the glass tube already mentioned.

The theory of the method* shows that, assuming rapid uniform

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* Let the volume of fresh air entering the room be v c.f. per hour. The volume of the room being V c.f. Take the CO_2 in the outside air as a c.f. per c.f. (approximately 0·0004).

Let the CO_2 at the start be x (c.f. per c.f. of air) and consider the case where no fresh CO_2 is being produced in the room. Three assumptions are requisite:—

1. That at the start the CO_2 is uniformly diffused.
2. That the volume of fresh air entering the room per hour remains constant.
3. That the fresh air instantaneously diffuses throughout the room.

The first condition can be controlled by thoroughly mixing the air of the room mechanically before commencing measurements.

The second condition cannot be controlled, but seems to have been fairly well fulfilled (see page 60).

FIG. 7.

VENTILATION. SEMI-LOGARITHMIC DIAGRAM.

Day Run. 22nd Feb. 1907 (Undivided Room)

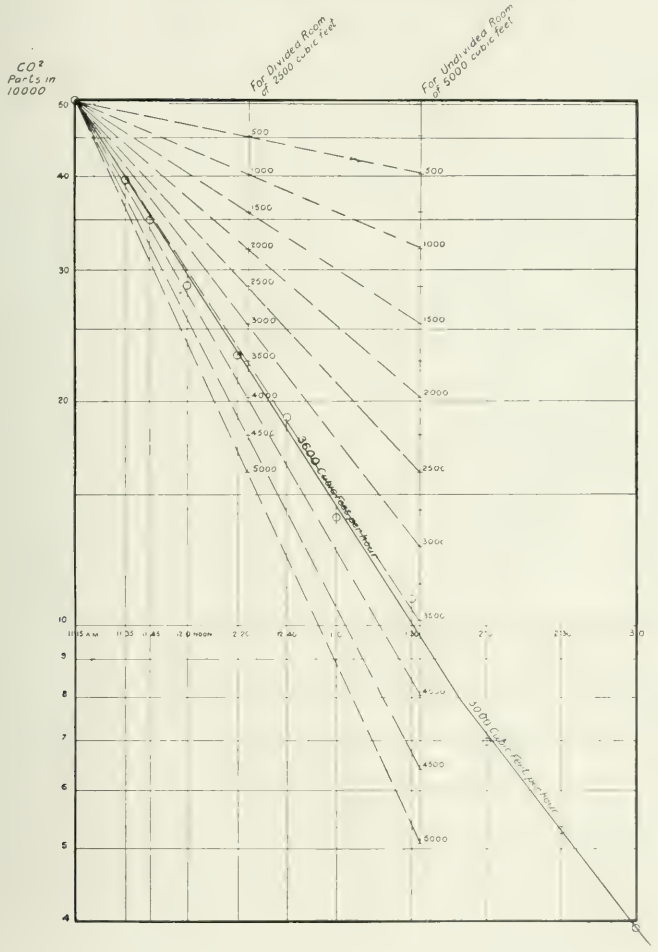
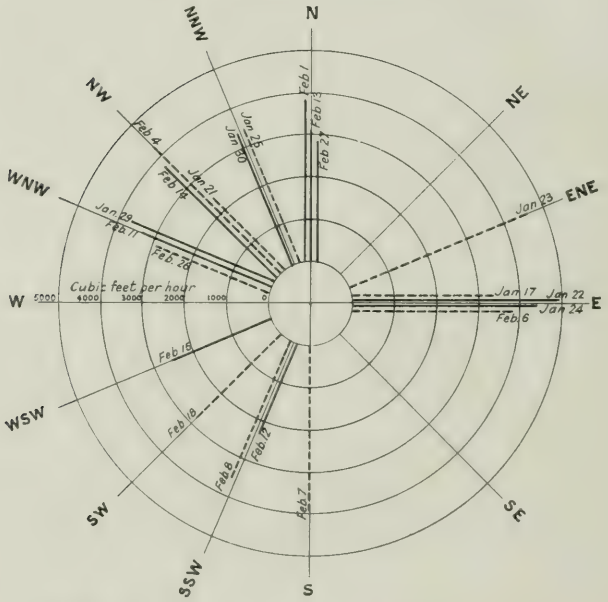


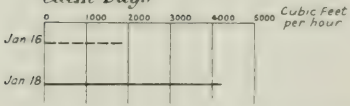
FIG. 8.

RATE OF CHANGE OF AIR WITH WIND BLOWING FROM DIFFERENT QUARTERS

(Undivided Room)



Calm Days



Average on days when there was wind.

Gas evenings shown by firm lines.
Electricity " " " dotted lines.

diffusion and uniform influx of fresh air, the logarithm of the carbon dioxide found (less the carbon dioxide in the outside air) should be a linear function of the time. This suggested a new and rapid method of dealing with the experimental data, which was found in practice to be very advantageous. In the usual method of calculation, two logarithms have to be looked out for any pair of observations, their difference taken, and this, after reducing to Napierian logarithms by the factor 2·303, multiplied by the volume of the room. Each pair of observations thus gives an independent value for the ventilation, and there is no means of discovering or rejecting a bad observation. Since on each day the ventilation was measured both immediately before and after the experimental run, necessitating at least ten or twelve observations, it was desirable that a more rapid method of reduction should be employed. For this purpose the observations (less the outside air carbon dioxide) were directly plotted on semi-logarithmic paper, in which the ordinates were the logarithms of the CO_2, the abscissæ the times (Fig. 7). The fact that the points thus plotted are found to lie approximately on a straight line shows that the conditions assumed in reducing the logarithmic formula are fairly well fulfilled, and doubtful observations can be eliminated at a glance. The difference of the ordinates for one hour taken off with a pair of dividers

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The third condition can only be approximately fulfilled, and fails altogether when the air enters in rapid currents at a few apertures.

At the start there is x. c.f. of CO_2 per c.f. of air. In the time dt. the volume of air entering is v. dt. c.f. and the same volume of air is expelled containing vx. dt. c.f. of CO_2. Hence, after the time dt. the total carbonic acid in the room will be $Vx - vx.\ dt. + va.\ dt.$ in c.f. In words this means the original carbonic acid, less the amount removed by the outgoing air plus the amount introduced by the fresh air.

This equals $Vx. - (x. - a)\ v\ dt.$ and this divided by the volume of the room gives the carbonic acid per c.f. after the time dt. (hours).

$$x - \frac{v}{V}(x. - a)\ dt.$$

Calling the *change* in carbonic acid dx. in the time dt., this gives

$$-\ dx. = \frac{v}{V}(x - a)\ dt.$$

Therefore, by arranging and integrating

$$\log_e (x - a) = \frac{v}{V} t + C.$$

In this expression V., the volume of the room is a constant, v., the amount of fresh air entering per hour, is assumed (Condition 2) to remain constant, and hence the Napierian logarithm of the CO_2 (less that of the outside air) should be a linear function of the time. Hence the use of the semi-logarithmic squared paper.

The constant C can be eliminated by integrating between limits, and the expression then becomes

$$\text{Loge}\ (x_1 - a) - \log_e (x_2 - a) = -\frac{v}{V}(t_1 - t_2)$$

where x_1 and x_2 are the amounts of carbonic acid at the times t_1 and t_2 hence, disregarding the negative sign, the practical expression becomes

$$v = \frac{2{\cdot}303\ V}{t_1 - t_2}\left\{\log_{10}(x_1 - a) - \log_{10}(x_2 - a)\right\}$$

and laid along the scale of equal parts forming the abscissae gives immediately, without referring to a table of logarithms, the difference of the logarithms to the base 10, and this multiplied by a constant 2·303 times the volume of the room, gives the ventilation in c.f. per hour.

Even this last calculation may be avoided by the use of a scale on tracing paper which, being superimposed over the logarithmic diagram, enables the ventilation figure to be read directly.

Later on recourse was occasionally had to a third process, consisting in burning gas in the room until a steady state was reached, when the rate of air-change could be quickly computed from the proportion of CO_2 present and the quantity made.

To control the application of the logarithm formula, some continuous runs, extending over several hours, were taken. On one of these, when there was little or no wind, the whole of the results fell upon a straight line within the limits of the known experimental error, but point on the whole to a slight change in the ventilation about the middle of the run. When the ventilation was increased to a maximum by opening the doors, chimney, etc., the carbon dioxide fell so rapidly that accurate measurements were impossible. The condition of uniform diffusion could hardly be assumed to hold on these occasions, and although the results fell moderately well on a straight line, the use of the usual formula appears hardly legitimate. For this reason, ventilation figures of over 8,000 c.f. per hour must be regarded as rough approximations only.

Comparison of Ventilation Figures.

As the ventilation figures began to accumulate, wide variations became apparent in spite of the precautions taken to maintain uniform conditions in the room. It was thought that these variations might be due to changes in the direction and force of the wind, and careful search was made for indications of some relation between the air supply and these factors. Fig. 8., p. 68, shows the ventilations observed in the undivided room when the wind was blowing from various points of the compass, and it will be seen that the variations in the former bear no relation to the direction of the latter. The air supply seems to be independent also of the strength of the wind, some of the highest rates recorded having coincided with light winds, and even with calms.

In the absence of any constancy in the ventilation conditions the air supply was measured both before and after each evening's run, and in the preliminary calculations the ventilation during the evening was taken as the mean of those observed in the fore and after periods.

AMOUNT OF RESPIRATORY CO_2.

The first use which was made of the ventilation figures was for the purpose of arriving at the amount of carbonic acid expired by the inmates of the room. Attempts had been made to obtain this information by means of a spirometer. The air expired during a definite time was received in a large bag of goldbeater's skin, the total volume and percentage of carbon dioxide being then determined. As data were accumulated, however, it became clear from the variation of the results for the same individual among themselves, and the divergence of the mean from the usually accepted figures, that the method was unreliable, and that no use could be made of the results. The inherent weakness of the spirometer method lies in the difference between the freedom of natural respiration and the constraint induced by having to breathe through a mouthpiece into a bag.

The measurement of the respiratory CO_2 in the act of production proving thus impracticable, it was decided to estimate it in the gross by calculation from the proportion of CO_2 in the room air and the ventilation figures. This method was only available on those evenings on which a steady maximum value for the CO_2 contents of the room was obtained. The ventilation of the room being known, say 3,000 c.f. per hour, and the steady CO_2 being also known, say 25 parts per 10,000 or ·0025 c.f. per 1 c.f. of air (the distribution of the CO_2 being assumed to be uniform), the CO_2 produced per hour would be—

$$3{,}000\ (\cdot0025 - \cdot0004) \text{ or } 6\cdot3 \text{ c.f. per hour.}$$

On evenings when gas was burning the known volume of CO_2 derived therefrom would have to be deducted from the total before the respiratory CO_2 was worked out.

Since the experimental errors on the two quantities measured can be taken as under 5 per cent., the CO_2 produced should be known to the same accuracy, subject, as stated, to the assumption of uniform diffusion. This method has the advantage over the spirometric one, that the respiratory CO_2 is produced under perfectly natural conditions of breathing.

From a series of calculations on these lines it appeared that in the undivided room up to March 1st the CO_2 produced per man under electric light averaged 0·74 c.f. per hour, between the limits 0·60 and 0·90. The average figure obtained on gas evenings was 0·59 c.f. per man per hour, with a range from 0·49 to 0·79.

There was thus a striking difference between the *apparent* output of

respiratory CO_2 under gas and that under electricity, but that the *real* output varied in anything like the same proportion was a suggestion palpably untenable. There were, moreover, wide variations between the productions under the same illuminant, which could not be accounted for by any such hypothesis. The obvious conclusion, therefore, was that the ventilation during the run was *not* accurately represented by the mean of the fore and after periods. Closer examination of all the data disclosed the fact that the changes in the ventilation rate were closely connected with those in the temperature of the room, or rather with the difference between this temperature and that of the outer air. This relation is clearly shown by the diagram (Fig. 9) of the ventilation rates for two weeks under gas and electric light. The dotted and firm black lines represent the ventilation in the fore and after period respectively, and the blue line the difference between the internal and the external temperatures. It will be seen that the ventilation figure was consistently much higher after the run than before it. The difference of temperature during the latter part of the evening, when the steady CO_2 figure was reached, was practically the same as it was in the after period, and it follows that the ventilation during the steady state was much nearer the second (or higher) figure than the first; consequently those values for the respiratory CO_2 obtained when there was least difference between the mean and final ventilations were to be preferred. These indicate a production of about 0·80 c.f. per head per hour, a figure which is very near the estimates of several well-known authorities, and has accordingly been adopted for the purpose of these calculations.

Careful record was kept of the number of people present from time to time, and of the quantity of gas burnt per hour, and from these data the hourly production of CO_2 could be calculated fairly closely. This being known, and the steady value of the CO_2 in the air of the room determined, the air supply could be arrived at by a calculation the reverse of that given on page 71. Thus on January 18th there were 7 people in the room and 4·51 cubic feet of gas were being burnt each hour.

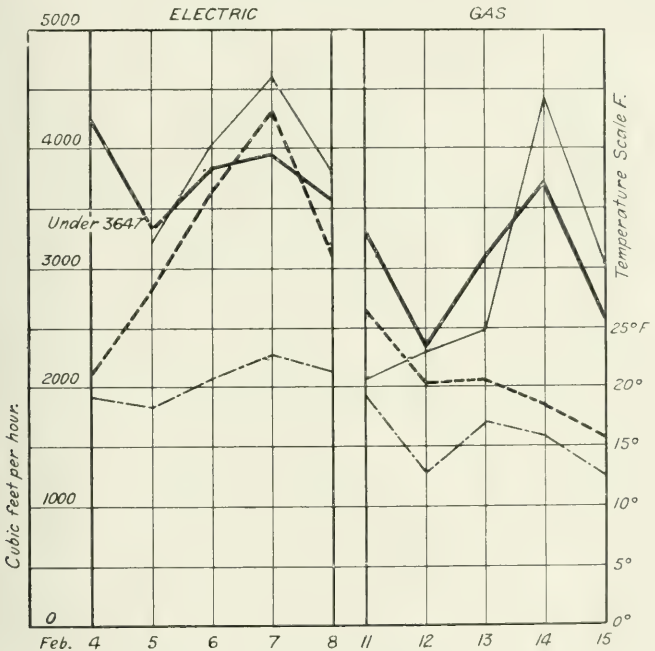
7 people at 0·8 c.f. per head give	...	...	5·6	c.f. CO_2
4·51 c.f. gas at 0·58 c.f. give ...	...	...	2·62	„ „
Total hourly production of CO_2		...	8·22	„ „

The CO_2 in the room reached a steady value of 23·5 per 10,000, or 19·5 above the outer air; and from these figures the volume of air which entered the room in the hour is obtained by simple proportion

as 19·5 : 8·22 :: 10,000 : 4,215

FIG 9

COMPARATIVE VENTILATION DIAGRAM
(Undivided Room)



Air Supply before run shown thus ----------

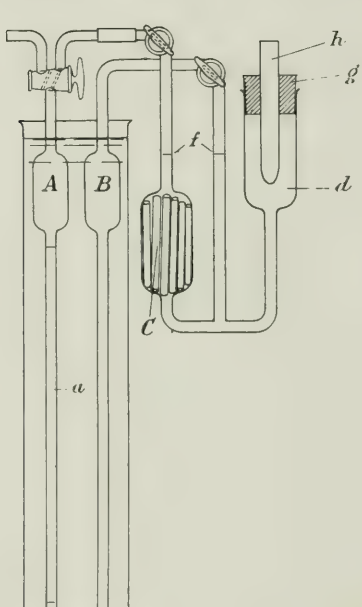
" " during " " " { Electric / Gas } ——————

" " after " " " ——————

Difference in Temperature between Room and outer Air shown thus —·—·—·—·—·—

FIG. 10.

APPARATUS FOR ESTIMATION OF MOISTURE.



A, Haldane gas burette : bulb, 15 cc, tube "a", 6 cc., graduated in ·01 cc.
B, Compensating tube, used dry : both in water jacket.
C, Cylindrical bulb containing glass tubes and sulphuric acid.
f, Datum lines for the adjustment of the burette volume against the compensator.
d, Reservoir to contain the overflow of sulphuric acid.
g, Ordinary cork fitting loosely into "d".
h, Tube closed at one end sliding easily in "g", serving to adjust acid level.

The ventilation figures for each evening have been calculated by this method, and with those for the fore and after periods were arranged in Tables, of which the following is a summary. The lines in Fig. 9 show the ventilations so calculated.

Air Supply in Cubic feet per hour.

	Average.	Maximum.	Minimum.
UNDIVIDED ROOM.			
Fireplaces and ventilators closed –			
Fore periods, all evenings	2,600	4,300	1,100
After „ „ „	3,213	5,700	1,600
During run, Gas „	3,525	5,400	2,300
„ „ Electric „	3,355	4,600	1,800
Fireplaces and ventilators open –			
Fore periods, all evenings	8,025	9,000	7,000
After „ „ „	8,000	(Single observation.)	
During run, Gas „	7,835	8,800	6,200
„ „ Electric „	7,200	(Single observation.)	
DIVIDED ROOMS.			
Fireplaces and ventilators closed –			
Fore periods, all evenings	1,597	3,400	800
After „ „ „	2,280	5,000	1,300
During run, Gas „	2,045	3,000	1,400
„ „ Electric „	1,961	2,400	1,400
Fireplaces and ventilators open			
During run, Gas evenings	5,078	5,900	4,300
„ „ Electric „	3,748	4,000	3,500
Fireplaces, ventilators and doors open. Windows open about 6 in.–			
Fore periods, one evening	*17,500	—	
After „ „ „	*29,000	*44,000	*20,000
During run, Gas evenings	*15,000	*16,000	*14,000
„ „ Electric „	*17,000	*21,000	*13,000
Ventilators and baize doors open. Windows open 2 in. at top. Fires burning –			
During run, Gas evening	*16,000	—	
„ „ Electric „	*15,000	—	—

* Rough approximations only. See note on limitation of method, p 70.

It will be seen that the average hourly air supply to the undivided room during the preliminary period, all inlets and outlets being closed, was 2,600 c.f., equal to one-half its contents, and that the quantity of air admitted to each of the divided rooms under similar conditions averaged 1,600 c.f. per hour, or two-thirds of the whole, and in each case considerably higher values were obtained later on. On certain days preliminary

ventilation figures were obtained without the corresponding evening or final ones, or *vice versâ*, and these are included in the foregoing averages, which are, therefore, not strictly comparable. As the relation between the ventilation in the different periods is of some importance, separate tables (Appendix 1 and 2, pp. 125, 126) have been prepared giving in parallel columns the values obtained on all the evenings for which the information is complete, arranged according to the state of the room and the illuminant used. The average ventilation during each period, the ratio of each to the value in the preliminary period, and the proportion of CO_2 recorded when the steady state was reached are as follows:—

	Preliminary Ventilation. c. f. per hour.	Ventilation during run.		Final Ventilation.		CO_2 during steady state. Parts in 10,000.
		c. f. per hour.	Ratio to Preliminary.	c. f. per hour.	Ratio to Preliminary.	
UNDIVIDED ROOM.						
Fireplaces and Ventilators closed —						
Gas evenings	2,587	3,579	1·38	3,185	1·23	29·5
Electric „	2,913	3,492	1·20	3,667	1·26	22·6
DIVIDED ROOMS.						
Fireplaces and Ventilators closed						
Gas evenings	1,335	2,002	1·50	2,239	1·67	41·1
Electric „	1,425	1,950	1·37	2,016	1·41	31·1
Fireplaces and Ventilators open						
Gas evenings	-	5,078	-	—	—	19·4
Electric „	—	3,748	—	—	-	19·3
Fireplaces, Ventilators, doors and windows open—						
Gas evenings	—	*15,260	-	—	—	8·7
Electric „		*17,027		—	—	7·2

* Rough approximations only.

Comparing the results in the undivided room, although the conditions, as shown both by the preliminary and final tests, were more conducive to ventilation on the electric than on the gas evenings, the actual ventilation during the run was greater on the latter than on the former. In both cases the air changes were more active during the evening's run than either before or after it, but whereas the evening ventilation under electricity showed an increase of only 20 per cent. over the preliminary figure, the rise under gas was 38 per cent. or nearly double.

The conditions in the divided rooms were somewhat different, the ventilation before the run having generally been determined by the steady

state method, the CO_2 being obtained by burning gas. This doubtless helps to account for the preliminary ventilation figures being proportionately higher than in the undivided room. These figures were generally from 10 to 20 per cent. higher in Room 6 than in Room 4, a difference which does not affect the comparison between the two lights, as these were alternated from room to room.

The average air supply during the run was again much greater than that during the fore period, the larger increase being as before observed in the gas-lit room. The final ventilation figures in both cases were still higher, the reverse having been the case before the room was divided. This was due in part to the candles which were burnt during a part of each evening for the purpose of the optical work, and which might at any time have added from 5 to 8 per cent. to the carbonic acid actually taken account of. It is possible, therefore, that some or all of the ventilation figures given for the mid period are from 5 to 8 per cent. too low. It may be observed also that complete sets of results were available for five evenings only in the case of gas and for eight in that of electricity, and although the figures are on the whole fairly consistent, they do not afford a sufficiently broad basis to justify close comparisons. Looking, however, at the results as a whole it is evident that better ventilation was secured with gas than with electricity, and there is little doubt that this was due to the strong currents set up by the heated gases from the burners. That this experience is not an exceptional one is shewn by the results of some German experiments in the illumination of school rooms and drawing offices reported in the *Zeitschrift für Architektur und Ingenieurwesen* of Wiesbaden for 1905. It was found that in occupied rooms with the crudest ventilation, such as openings near the ceiling, the carbonic acid was actually less with gas than with electricity, a result which is attributed to the increased circulation due to higher temperature.

In the case of the divided rooms the greater ventilation during the run cannot be accounted for in this way, as the gas was usually burning while the preliminary ventilation figure was being determined. The increase on these occasions was due to the occupants themselves, who, on an average, contributed to the room twice as much heat as the gas burners, besides keeping the air in motion by their own movements and their respiratory currents.

It remains to note the effect of the increased ventilation in reducing the proportion of carbonic acid in the air. The average hourly air supply in the undivided room being 2,587 c.f. and the yield of CO_2 from the gas 2·41 c.f., it follows that the gas burners would have increased the CO_2

content by $\frac{2{\cdot}41 \times 10{,}000}{2{,}587} = 9{\cdot}33$ parts in 10,000, if all the other conditions had remained the same. The average CO_2 figure for the electric evenings was 22·61 and that for the gas evenings 29·46, or 6·85 higher. This difference, which is only about three-quarters of the CO_2 produced by the gas, would have been still less if the original ventilation conditions had been equal, as the average ventilation, both in the preliminary and final periods, was considerably greater on the electric nights. Two sets of figures are therefore appended, each giving the results for an electric evening and a gas evening when the means of the fore and after ventilations and the number of people in the room were approximately equal.

Ventilation.

Date.	Illuminant.	Initial.	Final.	Mean.	Persons present.	CO_2 parts in 10,000.
January 25	Electricity	2,860	3,340	3,100	7·0	20·4
„ 18	Gas	3,420	2,880	3,150	7·0	23·5
February 6	Electricity	3,650	4,050	3,850	7·4	19·4
January 22	Gas	3,960	4,000	3,980	6·7	19·8

The foregoing results were obtained with restricted ventilation in the undivided rooms. The steady state ventilation determinations in the

Amount of Carbonic Acid in Divided Rooms during Preliminary "Steady State" determination and subsequent run.

Date.	Steady CO_2 : parts in 10,000. Preliminary test. Room 4.	Preliminary test. Room 6.	Subsequent run. Gas. Room	Subsequent run. Gas. CO_2.	Subsequent run. Electric. Room.	Subsequent run. Electric. CO_2	Difference. Gas greater.	Difference. Electric greater.
March 12	—	14·7	4	36·4	6	24·2	12·2	
„ 13	11·9	16·0	—	—	—	—		—
„ 14	14·3	13·3	6	38·3	4	32·2	6·1	—
„ 15 Morning ..	17·0	14·3	—	—	—	—	—	—
Afternoon	20·1	14·2	4	41·8	6	27·1	14·7	—
„ 18	20·1	14·1	6	34·2	4	36·6	—	2·4
„ 19	14·0	10·8	4	27·1	6	30·9		3·8
„ 20	20·0	16·2	4	51·6 (Mar. 21st) †	4	49·1	2·5	—
			6	39·9 †	6	31·1	8·8	—
„ *22	—	13·3	6	16·5	4	17·8	—	1·3
„ *25	14·8	—	4	22·3	6	20·8	1·5	
„ *26	15·2	13·2	6	8·4	4	8·4	—	—
Total	148·4	140·1		316·5		278·2	(15·8 − 7·5) ÷ 10	
Average	16·5	14·0		31·65		27·82	= 3·83	
„ 4 & 6	15·21							

* Ventilators and fireplaces open. † Steady state all but reached

divided rooms gave an opportunity of determining directly the proportion of CO_2 present when the gas had been burning continuously for twelve hours or more, and the CO_2 had therefore attained its maximum value.

The average CO_2 obtained in the nineteen preliminary trials was 16·5 in 10,000 in Room 4, and 14·0 in Room 6, giving for the two rooms a mean value of 15·2, or 11·2 above the outside air. It might therefore have been expected that the carbonic acid in the gas-lit room would have exceeded that in the electric room to this extent. Instead of this, the average of the former is only 3·83 parts above the latter, or for the restricted ventilation evenings 5·4 parts, representing respectively one-third and one-half of the excess produced. With ordinary ventilation the excess disappears altogether, the CO_2 figures in the gas-lit and electric-lit rooms with fireplaces and ventilators open being practically identical. The high excesses in the gas room on March 12th and 15th are partly due to the population of this room having been slightly the higher, but chiefly to the inferior ventilation of Room No. 4, which was 20 per cent. below that of No. 6. Taking the series as a whole both disturbing elements disappear, each light having been used on the same number of occasions in each room, and the number of people in each being almost identical (7·17 for gas as against 6·97 for electricity).

Distribution of Products of Combustion and Respiration.

From a hygienic point of view the *average* composition of the air of a room is of less importance than the character of that within the breathing zone, say from 3½ to 6 ft. above the floor. The sampling system already described was laid out specially to collect the air at different levels, and determinations were about to be put in hand when the work was brought to a close. Some information on the subject has, however, been obtained from a few sets of simultaneous samples taken at intervals along a single vertical line. Four gas sampling tubes with mercury bulbs were fitted to a frame with inlet tubes at the heights stated. By lowering a part of the frame carrying the bulbs all the tubes could be filled simultaneously with air from the corresponding levels. The contents of the tubes were then transferred over mercury to the Haldane apparatus and analysed in duplicate.

The following results were obtained: the numbers indicate the heights above floor level which are given in the table of averages:—

Proportion of CO_2 at different periods.

Date.	No.	CO_2 per 10,000.	
February 27	1	32·2	Gas alight for $1\frac{3}{4}$ hours before taking samples, 8 people in room.
	2	32·8	
	3	31·6	
	4	26·7	
February 28	1	25·0	Gas alight 45 minutes only before taking samples, 8 people in room.
	2	22·0	
	3	23·3	
	4	23·3	
March 1	1	17·9	Gas alight 2 hours before taking samples, 5 people in room.
	2	16·1	
	3	18·7	
	4	11·3	
March 20	1	53·8	(Sample at 9 feet gave 53·2).
	2	52·4	
	3	54·0	
	4	43·7	
April 4	1	16·7	Gas.
	2	13·9	
	3	13·4	
	4	10·7	
April 5	1	25·0	Electric with previous gas.
	2	26·8	
	3	20·1	
	4	15·6	

The average figures from these results are:—

	No. 1.	No. 2.	No. 3	No. 4.
Height above floor	9 ft. 10 in.	8 ft.	4 ft. 3 in.	6 in.
Distance below ceiling ...	6 in.	2 ft. 4 in.	6 ft. 1 in.	9 ft. 10 in.
Average CO_2	28·4	27·5	26·8	21·9
Ratio (average for whole room taken as unity)	1·09	1·05	1·03	0·83

It is clear, therefore, that at levels above 4 ft. from the floor the composition of the air is practically uniform, and that only just above the floor level is a lower CO_2 content to be found.

General Observation on Ventilation.

The foregoing results are the more significant in view of the massive character of the walls and ceiling of the rooms. It will be remembered that in the undivided room with fireplaces and ventilators closed, the hourly air supply was only equal to one-half of the contents of the room. In an experiment of Pettenkofer's, under similar conditions, an ordinary room in his house, of 5,620 c.f., that is to say, about equal in capacity to

one of the divided rooms, had its entire contents changed in one hour. There can be no doubt therefore, that in a dwelling house of the ordinary construction, much higher ventilation figures would have been obtained than are recorded in this Report, and that the superiority of the gas burners in point of ventilating effect would have been still more striking.

INFLUENCE OF TEMPERATURE AND HUMIDITY.

It has recently been pointed out by German writers, and in this country last year by Dr. Gordon, that the oppressive condition of the air of a crowded or badly ventilated room, and the unpleasant sensations which result from them are due, not as had been supposed, to any organic contamination of the atmosphere, but to its excessive temperature and humidity.

In 1883, Herman's experiments, already referred to, rendered it probable that respired air from healthy individuals was not very detrimental to health. Brown-Sequard and d'Arsonval came to the opposite conclusion, holding that an "Anthropotoxin" was given off, but this was disproved by Ben, Bauer, Lübbert, Lehmann and Jessen, Tormanek and others. Rietschel, in 1893, in addition to studying the chemical changes, considered the effects of the heat given off by human beings: and Kruger (1899) and Mehl (1903) brought forward the view that the ill effects of expired air were due to heat and moisture only.

More recently Flügge, making use of the result of the experiments of Heymann, Paul and Ercklentz, concludes that the thermal effects are the only ones needing consideration hygienically, and considers that the temperature of the room should never rise above 21° C. (say 70° F.), and where people are working 17° to 19° C. (say 65° F.)

Flügge summarises numerous experiments on healthy and sick people, and shows that the chemical changes produced in the gaseous condition of the air by the presence of human beings are not deleterious, but that the storage of heat (Warmestauung) in closed rooms is. He shows that temperature, moisture, and movement of the air are of much greater importance than mere chemical change, and that much of the benefit produced by ventilation is due to the removal of heat from the human body rather than to the chemical purity of the fresh air introduced.

The evil effects of overheating a room can frequently be avoided by increasing the circulation of the air within it.

L. Paul in 1905 placed ten persons in glass vessels of three cubic metres' capacity, measuring temperatures by hanging thermometers and moisture by Kop's hygrometer, and observing:—

1. Subjective symptoms.
2. Respiration and pulse.
3. Gärtner's tonometer (no results worthy of note).
4. Mosso's ergograph.
5. Mental test by performance of arithmetical work.
6. Measurements with Griesbach's æsthesiometer.

The methods aimed at the accumulation of chemical impurities, but these were found to have not much influence. Normal persons first experienced unpleasant symptoms at 70-86° F. with humidities of 45-86%, the effect occurring with a lower humidity at the higher temperatures, while in a single case it appeared at 69·8° F. with 56% humidity. The final conclusion was that "heat accumulation, and not chemical change of the air, is solely responsible for any unpleasant effects observed."

W. Ercklentz (1905) continued these experiments with sick instead of healthy people, noting the pulse, respiration, sensation and body temperatures only. No ill effects were observed except in one case of heart disease.

In the *Journal of Hygiene*, 1905, J. S. Haldane mentions the difficulty of working in a mine when the temperature of the air is high, especially if it is also very moist.

We have seen that the human product of greatest quantity is the water vapour; and the fact established by various investigators and confirmed by the present experiments, that the carbonic acid *per se* has no direct physiological influence, is in harmony with the now accepted opinion that temperature and moisture are the two sole factors bearing on the problem. From a careful comparison of the physical data with the physiological records, no aberration of any note has been established, and it must therefore be inferred that the physical variations were too small to produce any definite physiological phenomena. This was to be anticipated, seeing that the human organism has ample powers of accommodation, and it would therefore only be when the physical environment was beyond the common range that any derangement of the balance of physiological action would be developed. Although no comparison has been noticed of general import, the chart showing the fall in body temperatures has a general resemblance to that recorded by the hygrometric tables, so that it may be stated approximately that the drier the air the greater will be the fall in body temperature during the experimental period. The amount of moisture given off by the persons in the room is the determining factor, and that from the gas is so small as to make very little alteration in the hygrometric state of the room.

It seems established that high temperature and moisture have a pronounced action upon the respiratory exchange, which so alters the metabolism of those subjected to such change in the environment, as to render them less resistant to bacterial infection.

Attempts were made to ascertain, by actual experiment with the spirometer, the amount of water vapour and carbon dioxide given off by the breath. It was found that the number of respirations per minute did not appreciably alter the carbonic acid content of the expired air, but the experiments were abandoned, as it was impossible to get a determination of the amount of water evolved. Pflüger has, however, shown that the carbonic acid discharged is independent of the rate and depth of respiration, and that it is about 7·8 grammes per man per minute. Haldane and Priestly have also established the fact that the percentage of this gas in the alveolar air remains constant (5·6–6·31 per cent.) for the same individual, even when the rate of respiration is altered. It may therefore be concluded that the lower respiratory rate noticed in these experiments at the end of the evening's observations with both kinds of lighting had no effect upon the normal respiratory exchange.

Rubner (*Arch. f. Hygiene*, 1897), quoted by Leonard Hill ("Recent Advances," p. 268), has shown that the water output varies inversely as the humidity when the external temperature is constant. He found that the loss of water might be reduced 75 per cent. by surrounding the animal with wet instead of dry air, without any sign of disturbance. Again, the actual difference in heat production which resulted from varying the wetness of the air 35 per cent. was not equal to that produced by altering the external temperature 1° C. In another experiment a 25 per cent. increase in humidity equalled in effect a change in external temperature of 2° C. In the case of warmed air (25—30° C.) the evaporation of sweat proved to be a factor of greater amount, a 50 per cent. increase of humidity having the same effect as an increase in temperature of 5° C. A temperature equal to or above that of the body cannot be tolerated if the air be saturated with moisture. The favourable conditions of relative dryness of the air for workers are, at 18—20° C., 60—40 per cent. relative dryness; at 15° C., 30 per cent. relative dryness; and at 25—30° C., as dry as possible; at 25—30° C., 30—40 per cent. relative dryness is distinctly unfavourable (Wolpert).

Boycott and Haldane's "Study of the Effects of High External Temperatures" is in agreement with these conclusions. (*Proc. Phys. Soc. Edin.*, 1905.)

A simple practical rule for regulating the humidity of occupied rooms is supplied by Dr. Gordon, who states that comfort may be secured by keeping the wet bulb thermometer below 60° F.

The lower limit at which unpleasant symptoms begin to be felt has been variously stated. Dr. Billings, the American authority on ventilation, says that the humidity may fall as low as 15 or 21 per cent. without causing discomfort, but this opinion appears to conflict with that of Professor de Chaumont.

The results obtained during the present investigation are recorded in the subsequent sections.

(*a*) *Temperature.*—It was first of all necessary to determine the ordinary distribution of heat within the room, with a view to devising a system whereby its true average temperature might be ascertained from a reasonable number of observations. There were two directions in which temperature gradients were to be looked for, namely, in successive horizontal layers from the ceiling downward, and in successive circumferential zones from the walls inward. Accordingly a vertical chain of 9 thermometers was hung from the ceiling at point A on plan, p. 52, and a horizontal line of 6 thermometers a foot apart was placed between B and C about 5 ft. from the floor. Thermometers were also set on each mantelpiece, on the inner buttress of the arch between the two rooms, on the ceiling close to the head of the vertical chain, and on the floor near the outer wall.

The temperature at the floor level was generally about 5° below the average of the room; but with this exception the temperature was fairly uniform throughout, more particularly under electric conditions. Thus at 8.45 p.m. on Jan. 22nd, when the temperature of the outer air was 32° and the average of the room 52·9° (gas being the illuminant), the temperature at the ceiling was 2·9° above the average, and that at the floor 3·9° below it. Except at these two stations the highest temperature was 1·6° above the average, while at two points only were the readings as much as 1·4° below it. On the following evening the electric light was used. At 8.45 p.m. the average temperature of the room was 50·3°, and that of the outer air 29·8°. The ceiling and floor temperatures were respectively 0·7° above the average, and 3·8° below it. Of the remaining readings there was one only as much as 1·3° below the average, and only two which exceeded it by a like amount. On the gas night the difference between the top and the bottom of the vertical series was 3°, and on the electric evening 1·8°, the greatest differences found in the horizontal line being 1° and 1·1° respectively. The temperature has usually been about a degree higher towards the centre of the room than at the wall, but

the proximity of an assistant or subject to a thermometer has often caused greater differences.

It thus appeared that the only temperature gradient which need be taken into account in a study of the heat conditions was the vertical one, and that by taking the temperature of each horizontal stratum of air at a single point a good average figure might be obtained for the whole room. Accordingly, when the rooms were divided, a single vertical line of 6 thermometers was hung in each about 3 ft. from the centre of the partition, and two other instruments were placed on the mantelpiece and on the partition about 5 ft. from the floor. The temperatures given for the undivided room are therefore, with few exceptions, the averages of 21 or 22 readings at different points, and those in each of the divided rooms the averages of 8 observations.

It was remarkable how, in spite of the difference in the readings of the various thermometers, they all rose and fell together. Thus in Room 6 on April 2nd the greatest rise at any point from 7·25 to 8·25 p.m. was 0·8°, and the least 0·6°. Though the agreement was not on every occasion quite so close, it was sufficiently so to show that the temperature of the room rose and fell as a whole. There is every reason to believe that the heat was distributed by convection currents rather than by conduction. From this rapid and uniform distribution of the heat imparted to the air of the room, it seems reasonable to infer that the gaseous constituents of the air were similarly distributed, and hence that the samples taken were *fairly* representative of the whole.

In this connection the difference which has been pointed out between the temperature of the air against the wall and that nearer the centre of the room is not without significance. Of two columns of air, each a foot square and as high as the room, one being a degree warmer than the other, the former will weigh just 11 grains less than the latter, and this difference, slight as it is, will suffice to maintain an active and constant circulation. The heated streams of air from the gas-burners and the lungs of the occupants will rise rapidly to the ceiling, and spread outwards to the walls, down which they will flow, losing heat at every step of the way. The room will thus be surrounded by a shell of air in which the products of combustion and respiration will be present in somewhat greater proportion than in the body of the room. To this extent, therefore, their distribution will not be strictly uniform. The products in question, by reason of their proximity to the walls, will be favourably situated for removal by the constant interchange which takes place through them, as well as by more definite channels. It follows that the

ventilation figures which have been calculated from the known production of CO_2 may be slightly in excess of the truth. Seeing, however, that the function of ventilation is to carry off the combustion and respiratory products, its efficiency is to be measured by the thoroughness with which it does so rather than by the actual quantity of air removed. From a hygienic point of view, therefore, the conclusions reached are in no way vitiated by any inaccuracy of the ventilation figures due to the cause indicated. Bearing in mind that heat is the chief agent in promoting ventilation, it is significant that the amount generated in the undivided room was on the average 20 per cent. greater under gas than under electricity.

The temperature of the room, unlike the CO_2, has rarely reached a steady state during the evening's run. This difference in behaviour between heat and the gaseous products is due to the fact that the walls, ceiling, and windows of the room, which oppose a barrier (though an imperfect one) to the escape of air and its contained CO_2, actually conduct away the heat.

An examination of the temperature figures on several occasions shows that of the total heat lost from the room, only about 28 per cent. was carried off by the outgoing air, the remainder, amounting to 72 per cent. of the whole, passing off by conduction and radiation. These proportions varied within wide limits, according to the air supply and the differences in temperature between the room, the building generally, and the outer air. Thus, on April 2nd, when the ventilation was very low, only 5 per cent. of the heat was carried off by the outgoing air, whilst on March 25th, with very rapid air changes, nearly the whole of it escaped in this way.

The following table gives a summary of the average temperatures at the beginning and end of the runs, arranged according to the state of the room and the lighting :—

Arrangement.	Gas.				Electric.			
	Number of runs.	Degrees F.			Number of runs.	Degrees F.		
		Initial.	Final.	Rise.		Initial.	Final.	Rise.
Restricted Ventilation.								
Undivided room	22	53·6	57·0	3·4	18	54·0	57·2	3·2
Divided room	6	59·0	63·4	4·4	6	58·7	62·9	4·2
Fireplaces and Ventilators open.								
Divided room	2	60·8	63·9	3·1	2	59·2	62·7	3·5
Fireplaces, Ventilators, Doors, and Windows open.								
Divided room	2	58·4	57·5	−0·9	2	58·3	56·9	−1·4

In the case of the undivided room the averages of the initial and final temperatures are the same within half a degree for gas and electricity. In view of the fact that the observations were not made on the same, but on alternate evenings, and that the electric heater was in use a part of the time, the figures might have been regarded as a mere coincidence, had they not been closely confirmed by the experiments in the divided room, which were made on the same evenings in both cases and under strictly parallel conditions. It thus appears that in spite of the much larger yield of heat from the gas burners (more than double that from the electric lamps) the ultimate heating effect of the two illuminants was practically identical.

This somewhat unexpected result is probably due to the powerful ventilating effect of the currents set up by the gas flames. The greater part of the heat arising from the combustion of the gas is imparted to the air which passes through the globes, emerging at a temperature of from 450° to 500°F. At such temperatures it weighs barely half as much as the colder air of the room, and therefore mounts in a steady and rapid stream to the ceiling, over which it spreads, transferring to the ceiling most of its heat. The ceiling with its skeleton of steel joists thus performs for the air of the room the same office as the radiator of a motor car does for the circulating water. Hence only a small part of the heat from the gas is communicated to the main body of the air. The larger influx of fresh air due to the more active circulation set up helps further to moderate the temperature.

The hot column of air from the gas burners parts with its heat very rapidly, so that the ceiling temperature near the sides of the room shows no great excess above the room generally. The difference in the gas room was usually between one and two degrees, and that in the electric room under one degree. The air current from the electric lamps, being more sluggish, does not reach the ceiling so rapidly and hence the heat from them is not so rapidly dissipated.

A further observation which suggests itself is the very small extent to which the temperature rose on each occasion, in spite of the length of the run, the crowded state of the room, and the severely restricted ventilation. The conclusion may fairly be drawn that with modern methods of lighting the heat question is practically eliminated. On two occasions, March 11th and 12th) the lights were left burning all night, and the temperatures noted early the following morning, the results being given in the table:—

	Gas.	Electric.
Average temperature at beginning of run ..	55·5°	.. 56·5°
Rise.....	4·6	.. 3·7
Average temperature at end of evening	60·1	.. 60·2
Fall during night	4·3	.. 4·0
Average temperature next morning.....	55·8	.. 56·2

These figures show that neither illuminant was able to maintain the temperature which had been reached during the evening, which is thus shown to have been chiefly due to the heat given off by the occupants of the rooms. Further details of temperature are given in Appendix 3 and 4, pp. 127, 128.

(*b*) *Humidity.*—In the determination of moisture use was made throughout of the wet and dry bulb thermometers. The drawbacks of this instrument are well known. It is sluggish in its indications, and the usual tables for obtaining from the readings either the relative humidity or the absolute quantity of moisture, are calculated for outdoor conditions, and are, therefore, not directly applicable to instruments in a closed room. As, however, nearly all investigators, in working out the relations between quantity of moisture and physiological effects, have made use of the wet and dry bulb thermometers, the results are of practical value for comparisons.

Constants for the reduction of indoor observations were calculated by Regnault; but, as pointed out by Dr. W. N. Shaw, who has given some valuable suggestions bearing on this side of the enquiry, these constants probably hold good only when the air is near saturation, *i.e.*, when the difference between the readings of the bulbs is least. When the reading of the wet bulb is considerably below that of the dry bulb, convection currents are thereon set up which bring the indoor conditions into closer conformity with the outdoor, thus reducing the errors which result from using the outdoor table just where they would be most serious. In the absence of special tables for indoor work Glaisher's tables are generally used, and this has been done in the present case, since any corrections would be too small to affect the conclusions.

It was thought desirable, however, that the absolute amount of moisture per cubic foot of air should be determined if possible, and this on samples taken rapidly, as in the carbon dioxide determinations, so that rapid changes in the humidity of the air could be followed.

An examination of the previous attempts in this direction (see "Report on Hygrometric Methods, First Part, including the saturation method and

the chemical method, and Dew-point instruments," by W. N. Shaw, *Phil. Trans.*, 1888) showed that the problem was one of considerable difficulty. A special instrument was therefore constructed following on the lines of Schwackhöfer's apparatus, but provided with an automatic compensating arrangement like that used in the Haldane CO_2 instrument. In the latter the two manometer tubes and the levelling bulb containing the caustic potash are connected by rubber tubing. For a hygrometer containing strong sulphuric acid this arrangement is obviously inadmissible, and the following was therefore substituted. A large model Haldane burette and compensator were adopted, the graduated portion of the burette (*a*) containing 600 divisions, one of which was equal to $\frac{1}{2,000}$th of the whole volume enclosed, and as it was easy to read to $\frac{1}{10}$th of this by estimation, the accuracy of reading was 0·005 per cent. The spherical absorption bulb of the CO_2 apparatus was replaced by a cylindrical bulb containing glass tubes, to increase the exposed surface of acid, and this was joined in one piece to the tube leading from the compensating bulb, and to the bulb for holding the acid during the absorption. Since this arrangement does not permit of the latter bulb being used to adjust the levels, the adjustment in question is effected by means of a closed tube sliding loosely through a cork in the upper part of the acid reservoir. The delicacy of the adjustment can be altered by altering the size of the closed tube. It will be seen that the instrument is a modified Schwackhöfer, with the advantage that any changes in temperature and pressure are automatically compensated. This allows of a finer graduation, thus giving increased accuracy of reading, and as the readings are compensated no after corrections are required. Preliminary experiments with this apparatus disclosed one difficulty; whereas in the estimation of carbon dioxide two or three transferences between the burette and absorption pipette are ample for the complete removal of the gas, this is not sufficient to remove the moisture when strong sulphuric acid is used as the absorbent. There can be no doubt that the air is completely dried by one contact with the acid, the second transference being required by the air left in the dead spaces of the instrument. When this dried air is passed back into the burette for measurement it takes up a further proportion of moisture from the walls, and a third passage over into the acid bulb shows a slight diminution in volume. Each time the air is dried a small proportion of fresh moisture comes away from the glass walls of the burette, so that the readings of volume approximate slowly to a constant value. On this account from eight to ten transferences are required before the readings become constant. This is a serious disadvantage, as a

single determination becomes a tedious affair. A modification which may get over this difficulty was proposed, namely, that the sulphuric acid should be replaced by water, and the *increase* of volume required to saturate the air noted. Further experiments on this instrument were put a stop to by the shutting down of the work. It can probably be developed into a practical working instrument, but the hygroscopic properties of the glass will put a limit to its accuracy and speed of use.

The apparatus is shown in Fig. 10, p. 72.

The word "humidity" is always understood in a relative sense: that is to say, it signifies not the actual amount of moisture in the air, but the ratio between this amount and the quantity which is required to saturate the air. This quantity varies with the temperature, being least at low temperatures, and rising in a much higher ratio than the temperature.

Air which is saturated with water vapour at 32° will consequently be comparatively dry when raised to 60°, the relative humidity falling from 100 per cent. to 35 per cent., although the actual amount of moisture remains unchanged. For this reason the humidity in the rooms has generally been less than that of the outer air, the increase in the temperature having lowered the (relative) humidity more than the addition of moisture from the gas and lungs has raised it.

The difference between the internal and external humidities would have been still greater had it not been for the action of the surfaces of the room. These also, though apparently dry, hold moisture in large quantities: so that a shallow layer of the surface of the walls and ceiling contains more water than all the air in the room. There is ordinarily a continual exchange between the air and the room surfaces: if either becomes moister it gives up water; if it becomes drier it receives moisture. In this way the walls serve as a compensating reservoir to help to maintain the humidity of the air approximately constant. When the air has been hotter and drier than the walls, the latter have ordinarily parted with moisture to the former. Afterwards, when the air has cooled and become (relatively) moister, it has given back moisture to the walls.

In the undivided room the final humidity was 80 per cent. or over on twelve evenings, seven under gas and five under electricity: but on all but one occasion, when water was purposely evaporated in the room, the temperatures were low, ranging down to 51·9°. Had the room been warmed to 60°, or over, all these high humidities would have been reduced. The divided rooms were warmer, and on no ordinary occasion was the humidity in either of them at the end of the evening over 79 per cent.

It was thought desirable to push the humidity in both directions to

such a point as to permit a study to be made of the effects of a large excess and a large deficiency respectively. On several occasions, therefore, water was evaporated during the day by means of electric kettles and beakers placed on the electric heater and (when gas was to be used during the evening) by a Bunsen burner. This was done in the undivided room on February 26th, 27th and 28th, the 27th being a gas evening and the other two electric. The largest quantity evaporated was about twelve pints on February 28th, and the highest humidity reached 84 per cent., at 8.25 p.m. on that evening. A notable feature of these experiments was the small proportion (from 10 to 12 per cent.) of the water vaporised which was found in the air of the room. On none of these occasions were any noticeable effects produced.

The experiment was repeated in the divided room on March 20th and 21st. On the former evening gas was used in both rooms and on the latter electricity. Water was evaporated during the day by means of the electric kettle and (for forty minutes in the case of Room 6) by a Bunsen burner. By 4.20 p.m. humidities of 94 per cent. were reached in both rooms (with temperatures of 62·4° and 61·7°) but by 6 p.m. these figures had dropped to 76 per cent. and 72 per cent. respectively.

On the following evening the electric kettles were kept going till 8.30 p.m., the temperatures and humidities being as follows :—

	5.15 p.m.	6.15 p.m.	8.15 p.m.
Room 4 ...	62·8° 98% ...	65·8° 83% ...	67·8° 86%
Room 6 ...	61·0° 99% ...	65·2° 87% ...	67·0° 95%

The air in both rooms was distinctly close, but no marked discomfort was experienced.

On March 28th an experiment was made with dry heat, each room being warmed by a good coal fire and an electric heater. The ventilators and the baize doors were open, and the windows were opened 2 in. at the top. The temperatures, etc., were as follows :—

	Average temp.	Dry bulb.	Wet bulb.	Difference.	Humidity.
Room 4—(Electric): 7 p.m.	68·8°	69·6°	59·3°	10·3°	52 %
9.30 p.m. ...	71·1°	73·6°	61·2°	12·4°	46 %
Room 6—(Gas): 7 p.m.	70·3°	69·0°	61·0°	8·0°	61 %
9.30 p.m.	74·0°	73·0°	63·2°	9·8°	55 %

Both rooms felt very warm, but not oppressive.

	Thermometer.			Grains of Moisture.			Humidity* per cent.
	Dry Bulb.	Wet Bulb.	Difference.	Per c. f.	Whole Room.	Required to complete saturation.	
UNDIVIDED ROOM.							
Gas Evenings (20) –							
Outer air...	42°	39°	3°	2·46	12,300	.....	78
In room, Initial... ...	53·36°	49·17°	4·19°	3·43	17,150	5,900	73·9
„ Final	56·70°	52·87°	3·83°	3·97	19,850	5,950	76·6
Change	+3·34°	+3·70°	−0·36°	+0·54	+2,700	+50	+2·7
Electric Evenings (17)—							
Outer air...	42°	39°	3°	2·43	12,150	.....	77
In room, Initial... ...	53·17°	48·79°	4·38°	3·35	16,750	6,150	72·7
„ Final	56·21°	52·20°	4·01°	3·85	19,250	6,150	75·4
Change	+3·04°	+3·41°	−0·37°	+0·50	+2,500	0	+2·7
DIVIDED ROOMS.							
Restricted Ventilation—							
Outer air (7 evenings) ...	47·8°	44·3°	3·5°	2·96	7,400	.....	76·6
In Gas room, Initial ...	59·2°	54·1°	5·1°	3·98	9,950	4,100	70·1
„ Final ...	63·1°	58·3°	4·8°	4·70	11,750	4,250	72·9
Change	+3·9°	+4·2°	−0·3°	+0·72	+1,800	+150	+2·8
In Electric room, Initial.	58·3°	53·4°	4·9°	3·91	9,775	3,850	71·4
„ Final .	62·5°	57·9°	4·6°	4·67	11,675	4,000	73·6
Change	+4·2°	+4·5°	−0·3°	+0·76	+1,900	+150	+2·2
Natural Ventilation (Fireplaces and Ventilators open)—							
Outer air (2 evenings) ...	54·2°	50·1°	4·1°	3·54	8,850	.....	74·5
In Gas room, Initial ...	61·6°	56·3°	5·3°	4·27	10,675	4,550	69·5
„ Final ...	64·5°	59·1°	5·4°	4·71	11,775	4,975	70·0
Change	+2·9°	+2·8°	+0·1°	+0·44	+1,100	+425	+0·5
In Electric room, Initial.	59·6°	54·7°	4·9°	4·07	10,175	4,050	71·0
„ Final .	63·0°	57·8°	5·2°	4·52	11,300	4,650	70·5
Change	+3·4°	+3·1°	+0·3°	+0·45	+1,125	+600	−0·5
Increased Ventilation (Doors and Windows open)—							
Outer air (2 evenings) ...	54·9°	51·0°	3·9°	3·68	9,200	.....	75·5
In Gas room, Initial ...	58·4°	52·2°	6·2°	3·58	8,950	4,725	65·0
„ Final ..	57·3°	51·5°	5·8°	3·52	8,800	4,350	66·0
Change	−1·1°	−0·7°	−0·4°	−0·06	−150	−375	+1·0
In Electric room, Initial.	58·4°	52·5°	5·9°	3·65	9,125	4,550	66·0
„ Final .	56·5°	51·2°	5·3°	3·52	8,800	4,080	68·0
Change	−1·9°	−1·3°	−0·6°	−0·13	−325	−550	+2·0
Windows opened, Fire burning—							
Outer air (1 evening) ..	61·8	54·8°	7·0°	3·85	9,625	.....	62·0
In Gas room, Initial ...	69·0	61·0°	8·0°	4·70	11,750	7,650	61·0
„ Final ...	73·0	63·2°	9·8°	4·86	12,150	9,900	55·0
Change	+4·0	+2·2	+1·8°	+0·16	+400	+2,250	−6·0
In Electric room, Initial.	69·6	59·3°	10·3°	4·13	10,325	9,450	52·0
„ Final .	73·6°	61·2°	12·4°	4·30	10,500	11,975	47·0
Change	+4·0	+1·9°	+2·1	+0·07	+175	+2,525	−5·0

* Not worked out from average thermometer readings, but averaged from actual moisture and humidity figures.

Moisture balance-sheets have been prepared, showing on one side the hourly amount of water vapour brought into the room by the incoming air, and that yielded by the gas and the occupants respectively, and on the other the amount carried off by the outgoing air. As a rule the output appeared to be less than the supply, the ratio of the former to the latter ranging down to eight-tenths. With natural ventilation, however, the output generally exceeded the supply, in one case by as much as 28 per cent. The explanation of these results probably lies in the fact that the amount of moisture produced exceeded that required to maintain the humidity of the smaller air supplies, the excess being absorbed by the furniture, walls, and ceiling. On the other hand, when large quantities of air were admitted, their capacity for moisture at the higher temperature of the room exceeded the supply, the balance being taken up from the wall surfaces in the manner already described. It should be added that, except on March 20th and 21st, when the walls were slightly clammy, there was never any indication of condensation thereon, the changes in their hygroscopic state being well within the limits of apparent dryness.

The balance-sheets were calculated from the readings of the wet and dry bulb thermometers, the ascertained amount of water produced by combustion, and the assumed quantity expired by the occupants. They were thus manifestly approximate only, and are therefore not appended, but the results are so consistent as fully to justify the above conclusions.

Humidity.—The figures relating to the humidity of the air are given in Appendix 5 and 6, pp. 129, 130, and are abstracted below, the occasions on which moisture was purposely added to the air being excluded.

At the beginning of the evening the rooms were generally from 4 to 10 per cent. drier than the outer air, but in the course of the run the difference was as a rule materially reduced. An exception occurs in the case of the nights with fires, when the humidity, initially low, was reduced by 6 per cent. and 5 per cent. respectively. Throughout the experiments there is a remarkably close agreement between the results under electricity and gas, showing that the illuminant plays a very small part in determining the condition of the room.

It is interesting to notice also within what limits the differences between the wet and dry bulbs at the end of each evening, and the corresponding humidities, ranged in the course of the experiments. These, with the average values, are summarised below :—

	Difference wet and dry bulbs.			Humidity.		Per cent. average.
	Greatest.	Least.	Average.	Greatest.	Least.	
UNDIVIDED ROOM.						
Gas nights—						
Outer air	5·2°	0·5°	2·88°	96	63	77·8
Room (all occasions)	6·1°	2·2°	3·83°	85	65	76·6
„ (under restricted ventilation)	4·9°		—	—	70	—
UNDIVIDED ROOM.						
Electric nights—						
Outer air	4·4°	1·1°	2·91°	71	69	77·1
Room (all occasions)	5·3°	2·8°	4·01°	82	68	75·4
DIVIDED ROOMS.						
Under restricted ventilation—						
Outer air	5·1°	0·9°	3·5°	94	65	76·6
In Gas Room	5·5°	3·5°	4·97°	79	69	72·9
„ Electric Room	5·5°	3·7°	4·59°	78	68	73·6

Billings summarises the matter by stating that to secure health and comfort under English conditions the air for respiration should contain from 65 to 75 per cent. of moisture. De Chaumont agrees that the percentage should not exceed 75 per cent.; but Hood considers that in artificially-heated rooms we should endeavour to maintain 82 per cent. Expressing the matter in terms of thermometer readings, De Chaumont states that the difference between the wet and dry bulb thermometers ought not to be less than 4° nor more than 5°.

THE ORGANIC MATTER IN THE AIR.

It has been asserted by many observers that, in addition to respiratory CO_2, the breath contains volatile organic substances which are injurious to health. The incorrectness of this statement has been already shown (p. 79). Carbon dioxide is now known to be without injurious effects in any proportion which could arise in a living room; and when limits are set (as in the Factory Acts) to the amount of CO_2 permissible, it is always looked upon as a matter of these hypothetical organic substances of indefinite nature. This is generally emphasised, as already mentioned, by setting two limits, one for respiratory CO_2 alone, the other including the gas given off by illuminants.

A method that has been often tried for estimating these vague substances is the determination of the oxygen required to oxidise them—

potassium permanganate solution being the usual oxidant. It seemed desirable to apply this method in the present experiments, as two possible effects were anticipated. As a considerable proportion of the air of the room comes within the high temperature of the flame, some of these organic substances, if really existing, might be burnt, and the air purified to a corresponding extent. On the other hand, the burning gas itself might add substances capable of reducing permanganate solution.

The method of Carnelly and Mackie was expedited so that the determinations were made at the same time as those of carbonic acid. This necessitated smaller samples of a Winchester quart each. The bottle was filled by aspiration with a suitable bellows and 40 c.c. of a millinormal solution of acid permanganate introduced. After shaking thoroughly for three minutes, 35 c.c. were introduced into a Nessler tube with 50 c.c. of distilled water and matched against 35 c.c. of the original standard solution, similarly diluted, by adding standard $K\,Mn\,O_4$ from a burette until the colour of the standard was reached, when the amount required was the amount of permanganate that had been reduced by the air. The tubes were shielded with cardboard, so that the colours were matched by light transmitted throughout the whole length of the liquid: this was found to assist the eyes and to lessen the difficulty of conducting the experiments by artificial light. The results have been calculated to the volumes of oxygen used up by one million volumes of air.

A simple calculation shows that the sulphur dioxide which may be evolved from the gas is a negligible quantity in these experiments, even on the extreme supposition (known experimentally to be inaccurate) that *all* the sulphur in the gas is evolved as SO_2.

The results, summarised in the two tables on p. 95, are not easy to interpret. One or two facts are clear.

1. The substance measured increases in an electric-lit room in which people are present, and is presumably therefore a respiratory product.

About 19 hours' continuous gas-burning with no people present also gave fairly constant and high values. There are thus two kinds of organic matter in a gas-lit inhabited room, in the same way as there are two kinds of carbonic acid.

2. On those evenings on which the carbon dioxide reached a stationary equilibrium value the amount of "oxygen absorbed" also reached a stationary value, and at about the same time of the evening.

3. In rooms in which no gas was burning the increase in this figure was about 5·8 volumes of oxygen per million volumes of air in the undivided room and 4·7 in the divided room.

4. This increase is *less* when gas is substituted for electric light, 3·7 in the first period and 2·7 in the second period. With gas alight there is thus a decrease in the organic contents of the room. The obvious conclusion is that some of these organic substances, generally held to be injurious to health, are destroyed by the incinerating action of the gas flame.

The average results in the divided room confirm those obtained from the undivided room. The considerable divergences between single observations on different evenings, divergences not attributable to changes in the number of occupants or other factors under control, would tend to shew that organic dust particles in the air probably account for many of the high figures which have been put forward by other observers, and which have also been found in the course of this investigation.

Some of the respiratory products, a rough measure of which is supposed to be given by the oxidation with potassium permanganate, are probably nitrogenous, and attempts have been made to identify one of them with formamide. It appeared to be of sufficient interest to attempt to confirm the conclusions drawn from the permanganate experiments by seeing if it were possible to directly determine the total organic nitrogen of the air. The problem proved to be one of extreme difficulty, and many abortive experiments were made. The apparatus deemed likely to give the best results was as follows:—An ordinary tower, such as is used in the Gas Referees' apparatus for determining sulphur, was filled with large glass beads and moistened with specially purified distilled water. The air was drawn through this at the rate of 6 c.f. per hour, and measured, after passing through the tower, by an ordinary dry meter. The tower was then repeatedly washed with small quantities of organically pure water until the total amounted to 300 c.c. This was then distilled for the free ammonia and the residue submitted to a Kjeldahl determination. The method is unavoidably wasteful as regards time, and attempts were being made to simplify it when the experiments were stopped.

Organic Matter in the Air.

The figures shown (p. 95) are expressed in volumes of Oxygen consumed, per million volumes of Air, and are the results obtained on sixteen evenings between the 13th January and 7th February.

Gas was burnt on nine and Electricity on seven evenings.

PERMANGANATE ABSORPTION RESULTS.

I.—*Undivided Room.*

Date.	No. of persons present.	Light.	Air outside.	Room 5.45 p.m.	Room 7.30 p.m.	Room 9.0. p.m	Remarks
Jan. 13	7·0	G	under 3	8·7	11·1	12·2	
,, 14	6·5	G	,,	4·0	7·8	10·1	
,, 15	8·0	E	,,	4·0	8·7	11·4	
,, 18	7·0	G	5·3	8·4	6·0	6·6	Foggy day.
,, 21	9·0	E	5·3	5·0	13·0	13·0	Figure remained constant similarly with CO_2 figure.
,, 22	7·0	G	under 3	4·0	8·4	8·7	
,, 23	6·0	E	1·3	3·4	6·1	7·8	
,, 24	7·0	G	under 3	3·3	6·5	6·5	
,, 25	7·0	E	3·5	5·6	7·4	9·6	
,, 29	8·0	G	4·2	3·0	8·7	13·1	
,, 30	8·0	G	under 3	1·8	4·6	4·6	
,, 31	8·0	G	under 2	8·9	12·4	15·4	Air full of coal dust.
Feb. 1	6·0	G	2·4	3·7	6·4	4·1	
,, 4	8·5	E	2·4	4·9	5·6	7·2	
,, 6	7·0	E	8·7	6·1	8·7	8·7	
,, 7		E	6·0	4·1	11·0	11·0	
Average Total =			2·8	4·9	8·0	8·8	
do. Gas =				5·3	8·0	9·0	Rise 3·7
do. Electric =				4·0	8·6	9·8	,, 5·8

II.—*Room Divided March 14th to 26th.*

Gas was burnt on five and Electricity on seven evenings.

Date.	Room.	Light.	No. of Persons.	Oxygen Equivalents— At 6 p.m.	Oxygen Equivalents— At 9 p.m.	Remarks.
Mar 15	4	G	7·3	10·0	16·0	Gas had been burning since previous night
	6	E	6·5	11·0	18·0	when first readings were taken.
,, 19	4	G	7	8·9	12·9	Gas burnt since previous night, but room
	6	E	8	7·7	9·0	ventilated to some extent.
,, 21	4	E	8	6·9	17·5	CO_2 constant, 51; highest recorded for electric light. Ventilation extremely low.
	6	E	7	3·8	8·7	CO_2 constant, 32.
,, 22	4	E	7	7·5	13·7	No gas burnt in Room 4 all day.
	6	G	7	12·5	12·5	Gas burnt since night in Room 6.
,, 25	4	G	7	5·0		Fireplaces and vents open in both rooms.
	6	E	7	8·7		
,, 26	4	E	7	5·5	3·8	Fireplaces, doors and windows open all through.
	6	G	8	3·1	3·8	Each room contained 8 parts per 10,000 CO_2.

Average, gas ... ... Rise, 2·7.
,, electricity ... ,, 4·7.

Effects of Possible Leakage with Special Reference to Carbon Monoxide.

In these investigations every care was taken that all the gas and electric light fittings, which were present throughout in both rooms, should be without fault.

In order to insure that no appreciable amount of unburnt coal gas was present in the rooms during the investigations, a very delicate test was made at frequent intervals by the determination in the room air of the amount of carbon monoxide, which is a constant constituent of coal gas, averaging 5 to 8 per cent.

It will be seen that the average of the figures obtained was a practically equal trace in both rooms under gas and electric light, and that carbon monoxide was only present in inappreciable quantities, and on no occasion amounted to one part CO per hundred thousand of air, except when a leak of coal gas was purposely arranged in the room.

Much objection has been raised to the use of gas on the ground of its poisonous properties if allowed to escape into the air unburnt, as might happen by the accidental turning of a tap, or by some leak occurring in a pipe. A similar objection could equally be advanced that injury or even death might be brought about by the imperfect insulation or fusing of an electric lighting cable. In each case it is simply a matter of good or bad workmanship or material, and therefore seems outside the hygienic question.

No doubt public attention has been called somewhat prominently to this subject by the increasing numbers of accidental and suicidal deaths reported in this country and America. Also by the increasing consumption of water gas alone, and mixed with coal gas.

The only poisonous product of moment in coal gas is carbon monoxide, and there are plenty of published data as to its poisonous effects. It was thought, however, that it would be not altogether outside this enquiry to test the amount of carbon monoxide present in the air, and also when various quantities had been allowed to escape in the gas in imitation of leakages, such as might happen to the gas fittings of an ordinary dwelling house. Besides this, three persons remained for four hours and twenty minutes in a room where a considerable quantity of gas was escaping, their symptoms were noted and frequent physiological observations made during the time they were there.

The determinations of carbon monoxide were made by Nicloux's process, the iodine liberated from iodic anhydride by the CO being collected

and taken up with chloroform. The tint was then matched with that obtained from a standard solution of potassium iodide.

The following table shows the dates on which the determinations were made, and the results obtained:—

Carbon Monoxide Determinations.

Date.	Room.	Illumination.	Vols. CO per million.
1907.			
March 13	No. 4	Gas	Less than 1
	„ 6	Electric	„ „
„ 14	„ 4	„	„ „
	„ 6	Gas	„ „
„ 18	„ 4	Electric	2·5
	„ 6	Gas	3·7
„ 19	„ 4	„	1·2
	„ 6	Electric	1·8
„ 20	„ 4	„	3·7
	„ 6	Gas	5
„ 21	„ 4	„	2·5
	„ 6	Electric	3·7
„ 22	„ 4	„	2·5
	„ 6	Gas	5
„ 25	„ 4	„	2·3
	„ 6	Electric	3·5
„ 26	„ 4	„	Less than 1
	„ 6	Gas	„ „
April 9	„ 4	Gas leak 0·12 c.f. all night	5·8
	„ 6	Window open, no leak	Less than 1
„ 12	„ 4	Gas leak 0·6 c.f. night	9·1 at 1 p.m.
	„ 4	Gas leak 8·8 c.f.	24 at 6 p.m.

Averages to March 26 ... Gas 2·52
Electric 2·30

On April 9th, 0·12 c.f. of coal gas per hour had been passed into Room No. 4 for the previous fourteen hours with the windows, doors, etc., closed. In No. 6 Room no gas was turned on and the doors and windows were left open. Taking the ventilation of Room No. 4 as 2,000 c.f. per hour and the coal gas as containing 5 per cent. of CO, then the constant of CO in the room would be three volumes per million.

The determination at 1 p.m., on April 12th, in Room 4 was made after 0·6 c.f. of coal gas had been passed into the room per hour for the previous eighteen hours. The amount was then increased at 3.25 p.m. to 8·8 c.f. per hour, and allowed to flow at this rate continuously with half an hour's intermission until another determination was made at 6.50 p.m. The ventilation was specially determined and found to be equal to 1,830 c.f. per hour. As the room was not airtight and a steady state had not been reached, the content of CO given in the table, 24 per million, shows that

the effects thus artificially produced were the same as would have occurred with a *permanent* leak of about 0·9 c.f. of gas per hour. On this occasion three subjects remained in the room of 2,500 c.f. air space, for four hours twenty minutes. Before entering, their pulses, respirations, body temperatures, diastolic and systolic blood pressures, the corpuscular richness of their blood and body weights were accurately taken. When in the room all these observations were repeated at nearly hourly intervals and symptoms constantly noted. The air was fanned for two minutes every quarter of an hour to insure a proper mixing. It is sufficient to note that no serious symptoms became manifest, in fact, in the case of one subject, pulsation in the temples was the only inconvenience felt; the other two were more affected; all, after a time, lost their sense of smelling gas while in the room, although it was described by those outside the door of the room as "very strong" and could not under any ordinary circumstances have remained long undetected. The physiological observations showed but a slight rise in the pulse rate, but a considerable rise in two instances of the respirations, and only a slight rise in the other subject. The blood pressures afforded no information, in one instance the difference between the diastolic and systolic pressures increased, in another it diminished, while in the third it remained the same. There was well marked relative increase in the coloured corpuscles and this has been noticed to occur with the inhalation of carbon monoxide and coal gas. The loss of body weight was very little in excess of the average.

From this experiment the inference is that in any quantity of gas likely to escape from an ordinary leakage there is no fear of any immediate danger to health.

The Bacterial Content of the Rooms.—In comparing the bacteriological conditions of an inhabited room, illuminated with gas or electricity, the contamination of the air being constant, the following factors would all tend towards lessening its bacterial content with gas lighting as against electricity:—

1. The cremation of organisms in the flames.
2. The sterilising effect of the sulphur acids from the gas.
3. The increased condensation on the cold surfaces removing organisms as well as the sulphur products.
4. Any increased ventilation of the room.

Under certain conditions increased ventilation (4) would not diminish the number of organisms, as for example, a room with only a few people present adjoining a crowded thoroughfare.

The temperature of the ordinary electric glow lamps has been dealt

with elsewhere in this investigation, but it must be remembered that this is sufficient to destroy the majority of living germs coming in contact with the globe—an ordinary 16 c.p. electric lamp immersed in a cup of water will maintain a temperature of over 80° C., which is beyond the thermal death-point of non-sporing organisms.

The quantity of air raised to a sterilising temperature by the heat from an incandescent gas-burner is greater than that required for the actual combustion of the coal gas. The temperatures of the escaping air from the two gas-burners in the Room No. 6 were found to average 448° and 508° F. respectively; the ordinary temperature of the room at the time being 57° F., the mean increase produced by the burners was 420° F. The net calorific value of the gas consumed was 1,382 B.T.U., of which possibly one-third was carried off by conduction and radiation; the balance of 921 B.T.U. is capable of heating 120 c.f. of air from 57° to 477° F. or 324 c.f. to the boiling-point of water.

During the early part of the above investigation, and before the rooms Nos. 4 and 6 were divided by the wooden partition, upwards of 100 bacteriological observations were taken in order to determine whether it is possible to demonstrate any reduction in the number of organisms with gas lighting.

Beyond protection from any gross contamination, all the determinations were made under normal conditions, that is to say, during the medical, chemical, and physical observations, but, owing to the unavoidable disturbances created at the commencement of each evening's work, by the various entries into the room, and the preliminary ventilation with the fan, the doors and windows being open, a marked decrease in the bacteria was found to occur (with exception to be noted) during each evening, irrespective of the illumination. In order to control this diminution the bacteriological observations were invariably made in duplicate, 30 minutes after closing the doors and windows, and again at the end of the evening.

As certain air-borne organisms capable of growth on nutrient gelatine develop slowly, the cultures were incubated as long as possible and for a definite number of days, before finally counting the number of colonies. Preliminary tests showed that the average numbers of moulds and rapidly liquefying organisms present in the rooms, were not excessive and that the subsequent incubation of the cultures could be protracted to 7 days at 20° C. The nutrient gelatine employed throughout the experiments was prepared from fresh beef broth containing 10 per cent. of gelatine and having a reaction of +1·5. During the earlier experiments gelatine plates

were exposed in duplicate in one position, but as closely agreeing results were obtained, it was found preferable to expose the plates simultaneously in different positions in the two rooms.

The organisms falling by gravity and air currents have been determined by the exposure of nutrient gelatine plates (Petri dishes) for a definite time in various positions in the rooms, and in the following tables the results obtained with the two illuminants are recorded as organisms per sq. ft. per minute.

Mean results from exposures on the centre table, Room No. 6.

Electric light.			Gas light.		
Date.	Start.	Finish.	Date.	Start.	Finish.
1907.			1907.		
January 7	93	26	January 2	101	42
„ 11	292	177	„ 8	94	85
„ 15	69	55	„ 18	91	49
„ 16	139	75	„ 22	142	18
„ 17	142	4	„ 29	126	39
„ 21	125	97	„ 30	96	42
February 7	54	42	„ 31	79	42
„ 8	60	49	February 11	160	109
			„ 15	105	84
Average	122	76	Average	110	57
37·7 % Reduction.			48·2 % Reduction.		

Exposure in various positions in the rooms.

	Electric Light.			Gas Light.		
Position.	Date.	Start.	Finish.	Date.	Start.	Finish.
	1907			1907		
Between Burners, Room 6	Feb. 6	57	35	Feb. 11	157	76
	„ 7	55	43	„ 12	84	48
	„ 8	37	25	„ 13	65	73
Centre, Room 4	Jan. 15	55	34	„ 11	115	85
	„ 16	73	48	„ 13	85	65
1 ft. from ceiling, Room 4	Feb. 7	43	25	„ 12	64	30
	„ 8	22	19	„ 13	45	27
Centre, Room 6	Jan. 17	42	43	Jan. 18	69	37
	Average	48	34	Average	85	55
	Reduction = 29·2 per cent.			Reduction = 35·3 per cent.		

Although, owing to the conditions of the tests, there is a considerable variation in the numbers of bacteria, the averages show a gain of over 10 per cent. reduction of the organisms falling on the table during gas illumination. This greater reduction with the gas is also maintained at various points in the rooms, but it is interesting to notice that this does not appear to be augmented, as might be expected, even directly between the burners.

Haldane has shown that the air of a room contains fewer bacteria after occupation than before, owing to the purification effected by the lungs of the inmates. The diminution observed is therefore partly due to this cause, and thus lowers the amount of purification attributable to both lights.

The organisms in suspension in the air were estimated by (a) filtering a definite volume through a small sugar filter, and (b) drawing a known volume of air through a glass tube coated inside with nutrient gelatine (Hesse's method). Unfortunately, these observations are not sufficiently numerous to strike any average; they had to be abandoned, as each of the filtrations required upwards of an hour, and it was not found practicable to adequately protect the tubes, with the various other investigations simultaneously being carried on in the rooms. The results are recorded as number of organisms per c.f. of air.

	Electric Light.			Gas Light.		
	Date.	Start.	Finish.	Date.	Start.	Finish.
	1907.			1907.		
Sugar tube	February 18	189	208	January 18	340	132
				,, 22	283	141
Hesse ,, ...	,, 18	181	130	,, 18	221	142
				,, 22	255	96

The condition of the moisture condensing on the cool surfaces such as the walls and windows, during the periods the rooms were closed with gas and electric light, was also studied. As the quantity of condensed water that could be expeditiously collected was very small, especially during electric lighting, an artificially-cooled surface had to be employed. In a previous investigation as to the condensation of the products of gas consumption in 1904, large glass globes filled with melting ice were suspended in the experimental rooms, and the condensed water dripping from the exterior surfaces examined; a modification of this method has been employed to determine the bacteriological condition of the condensed moisture.

The exterior surfaces having been sterilised, the globes of ice were suspended in the rooms some hours previous to the evening's work, so as to insure that the dripping of the condensed moisture was normal. The condensed water was collected and the number of organisms determined. In the subjoined table, the globes were in each case suspended 3 ft. from the ceiling in the corner of Room 4.

Organisms per Cubic Centimeter in Condensed Water.

Electric Light.				Gas Light.			
Date.	Start.	Finish.	Persons in room.	Date.	Start.	Finish.	Persons in room.
1907.				1907.			
February 6	12	15	8	February 11.....	4	0	8
„ 18	26	18	8	„ 15.....	6	0	9
„ 26	—	9	1	„ 27.....	—	0	4

It has previously been shown* that the minute traces of sulphur acids in the condensed water has a marked germicidal action, and these results very clearly demonstrate the destruction of living germs by the condensation continually taking place on cool surfaces of the moisture from the combustion of coal gas. It will be noticed that with the gas lighting the number of bacteria was found to be low at the start, due to the destruction of the germs taking place so soon as the gas was lit and before the required amount of condensed water could be collected. Further experiments are required in this direction to ascertain the rate of sterilisation and the absolute degree of sterility produced in the water.

Physiological.

The question as to whether there is, from the physiologist's point of view, any advantage to be gained in choosing between gas and electricity for illumination has now to be considered. If a complete answer, as to the combined action of moisture and heat with and without other respiratory products and those derived from combustion, is to be arrived at, further research, on strictly physiological lines, should be conducted without any restrictions or limitations as to the method to be pursued.

Effect of Accommodation.—To make this perfectly clear it must be remembered that in every living being there is a certain range of

* "On the Hygienic Significance of Sulphur in Coal Gas." Rideal, *Journ. R. San. I.*, XXV., 1904.

functional capacity, within which organs are capable of working, which determines the condition known as health. One organ or system may, by its increased activity, relieve the work of some other organ or system, and this is occurring from moment to moment during the whole of life. For example, everyone is aware that moisture is excreted more freely by the skin in a warm atmosphere than in a cold one. In damp air the action of the skin is greatly reduced, but no ill effects are experienced, since the kidneys freely take on the work of eliminating the excess of fluid from the blood. Again, note how the pupil of the eye contracts when exposed to a brilliant light, and so permits us to view without discomfort that which we could not otherwise look at. This compensating power is universal in the animal economy, and is often of a very complex character. So long as compensation can take place health is maintained, and no special inconvenience felt; but when the limit of compensation is reached, then discomfort and disease follow. Exceed the boundary of compensation, and then the domains of physiology end and those of pathology begin.

From the foregoing it will be gathered that those conditions are the most favourable to health in which the various organs are working at their mean, and no organ is compelled to perform its functions on the boundary line between a physiological and pathological state.

Hence it followed that, when considering the hygienic effects of the two illuminants, the necessity arose to determine first by clinical observation the states of functional activity maintained by various organs under each system of lighting. So far as the limitations imposed rendered it possible, this has been accomplished, and tables of the results are appended, pp. 131, 132, these also show averages and differences under gas and electric light.

Circulatory and Respiratory Systems.

The separate results of (1) the pulse, (2) respiration, (3) arterial pressure were carefully tabulated, but it will be more convenient to consider the three physiological functions under one heading.

1. *The Pulse Rate.*—The pulse is simply the dilatation and contraction of an artery caused by the forcing of blood into it by the contractions of the heart until full expansion is reached. When the cardiac valves close the artery then contracts, forcing the blood onwards into the arterioles. The arteries are always full, even when least extended, but of course the tension is higher when they are filled with blood to their fullest.

The pressure they sustain when they are at their least calibre (*i.e.*,

just *before* the valve of the large artery, the aorta, is opened) is called the diastolic pressure, while when they are at their greatest calibre (*i.e.*, at the moment they have received the blood-flow from the heart) is called the systolic pressure.

These two pressures have been determined in this investigation by means of the hæmomanometer devised by Dr. Oliver of Harrogate, and he has been good enough to examine the results obtained and compare them with the sphygmographic records.

The rate of the pulse primarily depends upon the frequency of the heart's contractions, while the heart's pulsations depend upon a very large variety of causes, according to the requirements of the whole organism, and it should therefore form a sensitive index to minute changes in environment.

The tension of the arteries is altered by change of temperature: when the skin is subjected to chill it becomes blanched, that is to say, the minute arteries contract, causing a diminution of their cubic contents and producing increased tension and pressure in the larger vessels. Heat causes an exactly opposite effect, and it was thought that any marked heat changes in the room due to variation in the mode of lighting would thus be detected, provided care was taken to eliminate any alterations in blood pressure due to nerve stimulus and nerve depression.

The total number of differential pulse-rate observations in the undivided room was 212: 107 with gas and 105 with electric light.

As a rule the pulse-rate fell in the interval between the first and second observation, the daily average only showing an increase on three occasions under gas. The greatest fall noticed with gaslight was an hourly average rate per man of 4·33 beats, on February 22nd, while the least was ·36, on February 27th. Similarly, with electric light the figures were 6* on February 25th and ·63 on January 15th. Of the three average gains the highest for gas was ·5 beats on January 1st. Taking the whole period mentioned above, the hourly average daily loss per man per hour was, under gaslight, 1·6 beats per minute: and under electric light the corresponding figure was 1·78, the difference being only 0·18.

After the room was divided, the 66 differential observations with gas and 63 with electric light on 14 days in both rooms, from March 7th to 28th, showed a daily average fall on every occasion. The greatest average hourly fall was on the 19th with gaslight, and on the 7th with electric light; the figures were respectively 5·26 and 5·23, corresponding to the

* One observation only.

two evenings when the ventilation was at a maximum, the air being changed 1·68 times per hour on the 7th, and 1·64 times on the 19th. The least average fall for gaslight was one on the 22nd, and on the 12th for electric light, the respective figures being ·86 and 1·07, while the hourly average fall for the whole period was, in the case of gaslight, 2·54, and in the case of electric light, 2·92.

Most of the variants, such as age, time of day, exertion, rest, mental excitement, fatigue, depression, temperament, position, whether standing, sitting, or prone, were to a great extent eliminated in these tests. After a meal the pulse rate is accelerated, and increased respiration (irrespective of exercise) generally renders it higher. At the close of a day's work there is usually, apart from actual exercise or excitement, a progressive decline of the pulse rate, and this is in accordance with what was observed.

Contrasting the two periods, a very decided drop in the pulse rate, independent of the source of light, occurred after the room was divided. Whether this drop was caused by increase in temperature or moisture due to the alteration in ventilation, or to a tendency to overcrowding, or entirely to the fact that the men in the second period started immediately after exercise is outside the scope of this inquiry.

As the drop in the pulse rate may be comparatively sudden, the conclusion based upon the assumption of a uniform fall per hour may be open to criticism. A comparison of the actual changes shows that in the earlier period 107 observations were made on the staff, giving an average pulse rate of 65·4, and that after exposure to the gas-light environment their average pulse rate dropped to 60·5, or a fall of 4·9.

105 observations on other days under electric conditions were made; the average pulse rate was 65·4 and it declined to 60·0, or a fall of 5·4.

During the second period 66 observations were made on an average pulse rate of 70·7, falling to 62·3 or a loss of 8·4 under gas; whilst 63 observations gave a pulse rate of 70·7, falling to 61·2 or a loss of 9·5 beats per minute under electric light. It will be noticed that all four records show a very similar, indeed, almost identical, pulse rate at the end of the evening run, a sufficiently striking result to warrant the conclusion that the environment was essentially identical. A slightly lower rate was, however, observed in both periods in the electric light rooms. The figures, as a whole, conclusively prove that the difference in the mode of lighting has practically no influence on the rate of pulse.

2. *Respiration Frequency.*—Differential observations were made from 7th January to 1st March in the undivided room, and from 7th March to 28th March in the divided room, the number in the first period being 98

with gaslight, and 101 with electric on 18 evenings in each case. In the second period of 16 evenings, 64 gas and 63 electric light observations were simultaneously made.

In the first period, January 1st to March 1st, the observations on 17 evenings showed a diminution in frequency, and those of only 2 a gain, under gas light; on 13 evenings there was a diminution under electric light, and on 4 an increase; on one occasion the gains and losses balanced each other. The average hourly loss in frequency was:—gas, ·329, electric, ·206. In the second period, 7th to 28th March, on 11 evenings the average hourly frequency fell, and on 3 it rose, both in the gas and electric lighted rooms. The average hourly loss in frequency in the divided room was for gas, ·328, and for electric light, ·323.

Up to 1st March the average hourly rate per subject showed the maximum increase to be ·678 and the minimum increase ·213 under gas light, while the corresponding figures for electric light are ·421 and ·082. The greatest hourly average loss of rate under gas was 1·227 and the least ·025, and for electric the greatest 1·17 and the least ·03. Taking all the observations, 98 with a frequency of 15·4 fell 0·9 to 14·5 under gas, and 101 with 15·24 fell 0·54 to 14·7 under electric light.

From the 7th to 28th March the maximum gain in rate under gas was 1·33 and the minimum ·03, under electric light it was 0·37 and 0·13 respectively. The diminution in the average hourly rate shows the greatest fall under gas light to be 1·17 and the least ·21, and the diminution under electric light to be 1·67 and ·01.

The respirations fell from 16·2 to 14·95 per minute under gas, or a drop of 1·27, and from 15·74 to 14·9 under electric light, being a drop of 0·86.

Here again it will be noticed that the change in environment, due to the altered condition of ventilation and density of population, has caused a greater difference in the respiratory act than change in the mode of lighting. In both periods, however, the respiration rate was lowered to a slightly greater extent under gas than under the electric light, thus according with the change noticed when studying the pulse rate. This does not necessarily mean that functional activity was diminished, as a very slight increase in the depth of respiration compensates for loss in rate.

3. *Blood pressures.*—The involuntary muscular fibres of the arteries are governed by nerves derived from the vaso-motor centres, and thus are enabled to contract or expand, and to exert or reduce pressure on the blood within them, balancing the haemostatic pressure exerted by the

cardiac contractions. The hæmomanometer indicates the pressure exerted and sustained by the blood vessels, while the sphygmograph by its tracings shows the relative extent of the distension and the character of the movements of the arterial walls, so that the first of these instruments may be regarded as a pressure gauge showing *tension*, and the second as an instrument recording form and rate of movement, or *tone*.

From January 1st to February 1st only systolic blood pressures were recorded in m.m. of mercury, but from February 4th to March 1st diastolic as well as systolic were noted, and both these pressures were then taken regularly to the end of the investigations, all being from the brachial artery.

Before the room was divided the total number of observations on the systolic pressure during gas light was 208, and diastolic 78. Under electric light 206 were taken of the systolic, and 102 of the diastolic.

In the period from 1st to 28th March, under each system of lighting, 50 observations were made on the systolic pressure, and 52 on the diastolic.

Sphygmographic record.—106 sphygmographic tracings have been examined, derived from subjects before and after exposure to gas and electric light, each pair of observations having been made on the same subject, and each tracing having been taken under identical conditions. It was found—

1. That there are recognisable indications of a slight rise of arterial tone upon the whole after exposure to both kinds of light, 28 (or 53 per cent.) of the 53 pairs of tracings affording distinctive evidence of this rise, 20 (or 37½ per cent.) showing no recognisable change, and 5 (or 9½ per cent.) indicating a reduction of tone. This general improvement in arterial tone may fairly be ascribed to rest.

2. That on comparing the tracings obtained under each of the two modes of lighting there is a greater rise of arterial tone apparent after exposure to gas light than to electric light, the rise being 68 per cent. in the case of gas light, and 39 per cent. in that of the electric light. This conclusion is moreover supported by the larger relative percentage (61 as against 32) in which the arterial tone was apparently unchanged or but slightly fell under the electric light exposure. But the observations recorded are not sufficiently numerous or sufficiently decisive to warrant an assured conclusion on the different effects of the two modes of lighting on the arterial tone. So far as they go they do, however, seem to point to the advisability of further inquiry.

The difference between diastolic and systolic pressure has been

mentioned on page 104. Tables are appended (pp. 131, 132) showing in figures the results of observations on both pressures. Too much importance must not be given to the actual figure value of these, because vascular tension varies considerably, accommodating itself both to the internal and external requirements of the organism. It will be perfectly fair, however, to class all the cases together in the following way:—(1) Those pressures which rose: (2) those which remained stationary, and (3) those in which there was a fall. Besides this, the difference between the lower (diastolic) and the higher (systolic) pressure may be expressed as Increasing, Decreasing, or Constant.

An examination of these data will be of interest, and are here given in tabular form:—

Summary of Hæmomanometric Observations.

Date.	Light.	Number of Observations.		Rises.		Falls.		Stationary.		Difference between D. & S.		Constant.
		D.	S.	D.	S.	D.	S.	D.	S.	Increase.	Decrease.	
1907.												
1st Jan. to 1st Feb.	Gas	—	67	—	25	—	31	—	11	—		—
	Electric ...	—	52	—	23	—	20	—	9	—	—	—
4th Feb. to 1st Mar.	Gas	39	39	18	21	16	13	5	5	21	13	5
	Electric ...	51	51	25	29	16	16	10	6	20	22	9
7th Feb. to 28th Mar.	Gas	25	25	15	7	3	13	7	5	6	15	4
	Electric ...	26	26	14	8	7	12	6	5	7	14	5

Arranged in percentage, these results are as follows:—

		Blood pressure changes. Gas.	Electricity.
4th February to 1st March	Increase	53·8	39·2
	Decrease	33·3	43·1
	Constant	12·8	17·64
7th to 28th March	Increase	24	26·9
	Decrease	60	53·83
	Constant	16	19·23

There is thus an apparent increase in the difference of the two pressures in the undivided room under gas: but after the room was divided the results obtained under the two lights show no marked difference on the hæmomanometric readings.

Number of Blood Corpuscles.—Frequent examinations were made of the number of corpuscles of the blood. The instrument used was Gower's modification of Hayem and Nachet's Hæmocytometer. It consists of a micrometrical cell so divided that each space equals two cubic decimillimetres. Into this a drop of diluted blood is placed, and by counting over a sufficient area under the microscope the number of corpuscles present is ascertained.

The number of corpuscles in a *cubic millimetre* of normal blood varies from about 5,000,000 to 6,000,000. Any marked diminution in their numbers indicates that the destruction of corpuscular elements is proceeding more rapidly than their production, or that the serum in which they are immersed is increased. Conversely, apparent increase in their number means relative decrease in the amount of serum.

Three tables were prepared: the first showing the quality of the samples taken from subjects who were in the rooms, but who were not specially under the illuminants. A second table showed the results obtained from the blood of two specially chosen subjects who remained under the direct rays for the time stated during five consecutive nights. The third table gives the result obtained from the mixed blood of all the persons present in the room. This was done for the object of comparison with the other tables.

The amount of moisture given off from the body reduces the serum and so increases the corpuscular richness of the blood. Taking this into account with other factors, it does not appear that either illuminant can be said, *per se*, to affect the corpuscular quality of the blood—*i.e.*, so far as these particular experiments have reached; more extreme conditions were outside the scope of this restricted enquiry.

Animal Heat and Body Temperatures.

The thermometers were specially made (Casella) graduated in tenths of a degree F., and verified at Kew. Temperatures were taken in the mouth at the beginning and end of each experiment, and Tables showing averages and differences are appended, pp. 131, 132.

It is hardly necessary to recall the parallelism between the production of animal heat and the combustion of gas and fuels, both depending on the oxidation of carbon and hydrogen or their compounds, and both including among final products carbonic acid and water. In the body the blood circulates and distributes the heat. The activity of internal organs and the rapidity of chemical change varies in different parts and under different conditions, but the amount of heat produced is usually more than

sufficient to maintain the uniform body temperature. The excess is carried off by evaporation, chiefly from the skin and lungs, and the balance is controlled in health by the nervous system. Hence the value of the observations on body heat as an indication whether there is any disturbance of the natural functions by either mode of lighting.

The *average* body temperature, 98·4° F., however, varies in health from hour to hour within well-defined limits of about 1·5°, the maximum being reached late in the afternoon, followed by a gradual decline to a minimum late at night. Under the conditions of these tests, with temporary occupation of the room and absence of feeding or physical exertion, a fall of body temperature naturally occurred in the subjects. If the average fall were sensibly different under the two systems of illumination, it would point to a difference in their influence.

As with the pulse rate, variation of environment may cause a comparatively sudden instead of a gradual drop in the body temperature, but as the time of observation on all the evenings was approximately the same, the changes are comparable.

During the initial period, 112 observations were taken on individuals entering a gas-lit room. Their mean body temperature was 98·5°; at the end of the run they had a mean temperature of 97·6°, showing a loss of 0·9° F. With electric illumination 106 subjects had an average initial body temperature of 98·4° and a final temperature of 97·6°, showing a loss of 0·8° F.

In the divided room also the final temperatures were very close to each other and the losses under the two lights were identical. 60 observations showed before gas-light influence 98·7° F. mean average body temperature, and 98·0° after about 3 hours' exposure, or a loss of 0·7°. 67 observations gave 98·60 as the mean body temperature before, and 97·9 as the mean body temperature after, electric light influence, or a loss of 0·7°.

There is thus no physiological difference between the two lights affecting the body temperature.

The following table shows the average differential temperatures under gas and electric light, calculated as a uniform loss of temperature per hour, per person, for each evening's observation:—

Observations from January 1st to March 1st before the Room was divided.

Illuminating agents.	Number of evenings on which observations were made.	Total time of Illumination.	Total number of persons subjected to examination.	Actual loss averaged for 1 person in 1 hour. ° Fah.
		hrs. mins.		
Gas Light	20	66 32	9 males	·264
Electric Light	19	64 5	9 „	·253

Observations from March 7th to 28th after the single was divided into 2 rooms.

Gas Light	16	48 25	10 „	·252
Electric Light	16	48 25	10 „	·216

From 1st January to 1st March, out of 218 observations taken, only 3 temperatures remained stationary during the evening, while 3 others rose slightly under gas light. Similarly under electric light 6 were stationary, (curiously all on the same day) when the loss of weight was also the highest, except when the ventilators were open and 4 rose. From 7th to 28th March, out of 127 observations taken 2 temperatures remained stationary, and 3 rose under gas light; and 2 were stationary while 4 rose under electric light. The rises in each cases were traced to a slightly catarrhal state.

It has already been mentioned that the average mean temperature of the divided room was 2°F. higher than in the earlier period. This rise of temperature, associated with an increase in the percentage humidity should cause the rate of fall in the body temperature to be retarded and at higher temperature, with greater saturation, should change the fall into a rise. The final body temperatures in the second period being about 0·3°F. higher may be taken as an indication in this direction.

It would appear that, as the number of observations has been sufficiently numerous to give mean body temperatures showing this distinct difference in the rate of fall with a slight increase in the mean temperature of the room, accommodation has not prevented the above indication of this influence in the present investigation.

Pembrey (*J. Physiol.*, Vol. XVIII., p. 363) and Martin (*Phil. Trans.* 1902 B., Vol. 195 p. 1) have studied the effect of variations in external temperatures upon the output of carbonic acid and body temperature of young animals and marsupials, and point out that an increase in external

temperature causes a falling off in the output of carbonic acid. A warm room tends, therefore, to quietness and a smaller evolution of carbonic acid, and this is accompanied by a rise in the body temperature.

Dr. Haldane (*Journal of Hygiene*, 1905) has shown that the temperature regulation of the body begins to fail under conditions of rest and still-air environment when the wet bulb temperature rises above 88° F. As no rise in the body temperature has been observed in these experiments, except in a few catarrhal cases mentioned, it is evident that the temperature and humidity of the air environment has been well maintained below the point at which they begin to produce objective evidence of harmful effect.

Body Weights.

Losses of weight may be computed to show the rate of loss, either per individual or per unit of weight, such as the kilogramme or the 100 lbs.

Pembrey says*, referring to these alternative methods, "The physiological unit, it cannot be too often insisted, is the animal, and there is some danger of misunderstanding when the results are always expressed in terms of 1 kilogramme of body weight. The ratio of surface to mass is in the case of warm-blooded animals a much more important factor." So far as the comparison between gas and electricity is concerned, the danger here indicated would have been minimised by the system pursued, of subjecting the same men alternately to both lights, but an error might have crept into the comparisons of the results obtained on particular evenings, if the men on one occasion had been heavier or lighter than those on another.

The records for the first three weeks were accordingly analysed, in order to ascertain which mode of computation was more applicable to the present case. During this period 8 men were under observation, and of these it was found that 4 weighed over and 4 under 9½ stone each.

The records for the two sets of men were therefore separated with the following result:—

	Men over 9½ stone	Men under 9½ stone.
Average weight per man	137·8 lbs.	122·4 lbs.
Number of runs	35	42
Average length of run	3·43 hrs.	3·44 hrs.
Total initial weight	4824·44 lbs.	5140·37 lbs.
„ final „	4810·65 „	5124·15 „
„ loss „	13·79 „	16·22 „
Average loss per man per hour	·115 „	·112 „
„ „ „ 100 lbs. per hour	·083 „	·091 „

* Recent Advances in Physiology, p. 491.

It will be seen that the hourly loss per man is thus much more nearly uniform than that per 100 lb. Pembrey's observation is thus confirmed.

During the whole period of the investigations at the beginning and end of each evening all heavy clothing and pocket contents were removed. The results prior to January 24th are given on page 112, and show that the aerial loss was equal to ·113 lb. per man per hour or at the rate of 2·72 lb. per 24 hours. The loss due to the difference in the weight of the oxygen inspired and the carbonic acid expired is not great and probably does not exceed ·2 lb. This leaves 2·5 lbs. for water lost by respiration and sweat. Trentz and Schumberg give for men at rest the figure of 2·06 lbs. per day which is increased by hard physical work to 6·27 lbs. After January 24th the bladder was emptied each time and identical conditions were observed in the first and second weighings. It was not considered necessary to correct for the difference of weight from moisture absorbed by clothing as this is well known to be small.

The total average loss for each night was calculated into average loss per man per hour.

Between January 24th and March 1st the maximum loss under gas was 0·416 lb., and under electric light 0·458 lb., the minima were respectively 0·225 lb. and 0·139 lb., and the mean average loss was, for gas 0·304 lb., and for electric light 0·292 lb. per man per hour.

After the room was divided (March 7th to 28th) the maximum under gas light reached 0·398 lb., and under electric light 0·418 lb., while the minima were 0·220 lb. and 0·243 lb. respectively. The averages are practically the same as in the first series, being 0·305 lb. with gas and 0·302 for electricity. The details are given in the Appendix 7 and 8, pp. 131, 132.

MENTAL FATIGUE.

The expression mental fatigue here means that a person who is so fatigued has less ability to perform mental work; that is to say, in doing work he will perform it with less accuracy and with greater loss of time, although he is still well within the limits of his power to work.

Environment has much to do with the production of fatigue, and it is probable that the cause of the affection of the afferent nerves in general may be brought about by the state of the blood imparting or not imparting that which is required by the tissues.

To test this, sums in addition were set at the beginning and end of each evening's investigation. Usually ten subjects took part in this test, the time occupied by each in performing his task was accurately taken,

and the difference in time occupied counted as gain or loss; similarly the number of errors made were counted; if they were less in the first calculation than in the second the difference was taken as a loss, while if they were less in the second than in the first it was counted as a gain. If the task was equally performed on each occasion both as regards time and number of errors, it was not considered that any fatigue had been experienced.

This test was applied on 13 different nights in the divided room.

The number of sums calculated in a gas-lit room was 65 and in an electric 54 between March 7th and 28th. The results are as follows:—

	In Time.	
Neither loss nor gain ...	Gas, 8 ...	Electricity, 15
Gains in minutes and seconds	„ 34′ 46″ ...	„ 34′ 10″
Losses „ „ ...	„ 22′ 25″ ...	„ 18′ 8″
	In Errors.	
Neither gain nor loss in result	Gas, 13 ...	Electricity, 7
Increase in errors	„ 70 ...	„ 72
Decrease „	„ 26 ...	„ 51
Correct results	„ 14 ...	„ 8

Now it will be seen from these figures that so far as mental ability to perform work is concerned, those who made an equal number of errors in their first and last calculations stood at the same level of mental ability on both occasions, and should therefore be added to those who on both occasions did the work correctly, so that the total under gas light who showed no mental fatigue really equalled *twenty-seven*, as against electric light *fifteen*.

On the other hand the gain in making less errors must be taken as the difference between the losses and gains in each case, which shows that under gas light the increase in errors was 44 as against 21 for electric light, thus making 23 in favour of electric light.

With reference to speed, deducting the losses from the gains, we have in the case of gas light an improvement equal to 12 mins. 21 secs. as against 16 mins. 2 secs. with electric light. This shows in favour of electric light 3 mins. 41 secs., while 8 under gas light and 15 under electric light indicated no signs of fatigue.

It should be mentioned that accuracy is more important than speed. Fatigue first shows itself not by losing pace, but by irregularity and the loss of power to co-ordinate. The loss of pace only becomes manifest later. Besides this, practice in performing any function certainly means

gain of time, before gain of dexterity and refinement of perception in performing work is seen.

The conclusion is that there was a general improvement in speed under both conditions, due to the fact that the subjects engaged were resting in the interval.

Impression on Senses.

It has already been noticed in this investigation that the Nicloux test for carbon monoxide records the presence of this gas in the air long before any smell of coal gas is perceptible.

In most of the investigations on ventilation in recent years, the sense of smell as well as the general impression on the senses has held a place as a physiological test of the purity of the air. Olfactory perception can be far more sensitive than the most delicate chemical tests, and might be able to detect a difference attributable to the mode of lighting which had not been otherwise indicated.

On five different occasions this test was carefully carried out, nine persons in all giving their opinion. Every care was taken so that no suggestion should be made by one to influence the opinion of another. Before anybody was allowed to enter the room the gas and electric lights were both turned on, though only one or the other had been kept alight from three to twelve hours in the closed room previously, gas light on four occasions and electric light on one only. Fifteen opinions were given as "doubtful," *i.e.*, they could not detect by their sense of smell or general sensation that gas had been burning; eight opinions were recorded that gas had been burning and were correct; while two were of opinion that electricity had been employed as the illuminating agent, which was also correct.

It would appear from this that no change can have been produced in the air of the room sufficient to affect so delicate a sense as smell with any degree of certainty, although each person giving an opinion had been requested to sniff the air through the nose, as well as to inhale it through the mouth, and to endeavour to detect any change between the air of the room and the outside air which might indicate gas as having been burnt.

Time Reaction.

A time reaction apparatus was used for testing the interval required for muscle to respond to "will force." The Page's electric reed employed vibrated 104 times per second; and a Pfeil's electric signal (set in motion by a dry-cell battery) marked the time interval, which was recorded on a revolving drum covered with carbon paper and driven by a small motor.

The subject was placed so that his back was towards the apparatus

and his hand on a switch in the electric circuit; the drum being in motion the operator switched on the current, so that the vibrations of the tuning-fork begin to be recorded on the drum.

The subject hearing the click of the operator's switch acted upon another switch which instantly cut off the current. The interval of time is thus shown by the number of vibrations recorded on the drum, and by counting these the exact time required by the subject, between the time of his recognition of sound and his action, was calculated in decimal parts of a second.

Observations at 5.30 and 9.30 were made on nine evenings between March 18th and 28th, eight subjects being taken on each occasion, the results showed a very slight slowing down of the velocity of the transmission of nerve force at the end of the evening, both under gas and electric light, the change of illumination making no appreciable difference.

Ophthalmic Work.

In an investigation connected with artificial lighting, it is obvious that one of the most important lines for research will be that one which is directed to determine the effect of the light employed upon the organ which transmits it to the brain. To arrive at a reliable conclusion, an examination of sufficient subjects to eliminate accidental error was made on each evening during the time the general medical and physical data were being collected.

After careful consideration it was decided that it was compulsory to limit the inquiry to eye fatigue tests, though it is worth while to point out that a more extended line of research, including a determination of the variation in the power of judging and comparing colours, and its concomitants, would be of the utmost utility, since in many occupations the choice between gas and electricity as an illuminant might be governed by such considerations.

In order to test the variation in the different kinds of fatigue experienced by the eye four series of tests were arranged, and 928 different observations were made between March 7th and 27th, and these are referred to as follows;—

1. The Perception Test, determined by recording the visual acuity at the commencement of the evening and three hours after, on Snellin's types at a distance of six metres.

2. The Orbicular Muscle Test gave the amplitude of convergence as ascertained by noting the strongest prisms that could be overcome, bases up, down, and out and in at the same distance. The unit of measurement

is the degree prism, and the figures give the difference in degrees before and after.

3. The Accommodative or Ciliary Muscle Test recorded the punctum proximum with the standard type at the beginning and end of the exposure to light for three hours.

4. The Retinal Test denoted the change in the light perception after three hours as measured by the difference in the number of opal glasses (1 sq. ft. to 1 lb.) through which the subjects saw light from a standard candle at 1 metre from the eye.

It must be borne in mind that these calculations merely show the gain or loss especially observed in each person subjected to the test, and have no reference to the question whether each individual possesses sight above or below the normal, nor would the figures be the same if the same sights were tested under some other illuminant. The results are relative, however, with regard to gas and electricity, the tests having been made under identical conditions for each light, and so are perfectly reliable for the particular purpose of comparison.

The general results of the investigation on sight are summed up in the following condensed table, from which it will be seen that under gas light there were eight gains and only two losses of visual ability, whereas under electric light there were only six gains against four losses on the same ten subjects, and in the preferential column the advantage for gas accrues to seven subjects and for electric light to only three, while on the whole ten subjects, gas appears as 54, against 8·5 units for electric light, giving a difference of 45·5 in favour of gas.

It will be seen that the sensitiveness of the eye to light, as measured in the perception test, is diminished very markedly after exposure to the electric light, whilst no corresponding effect is noticeable after the eye has been subjected to gas light.

The power of co-ordinating and using the motor muscles of the eyeball recorded in the orbicular muscle tests was diminished to a greater extent after subjection to electric than to gas light. It was found also that the ciliary muscles of the eye are more accommodative after three hours' exposure to the light of 50 candles derived from the Darwin incandescent gas lamps than to a similar amount of illumination produced by the incandescent carbon filaments. The acuity of vision measured by the retinal test again shows that the optic nerve or centre was more susceptible in the case of the gas illumination.

The total advantage accruing to the individuals examined shows that there were only two small gains under electric light, while there were

SUMMARY OF OPHTHALMIC TESTS.

Letter	ELECTRIC													GAS.												Preferential Light.	
	Perception.			Accommodative.			Retinal.			Orbicular.			Total Gain or Loss.	Perception.			Accommodative.			Retinal.			Orbicular.			Total Gain or Loss.		
	1st Test.	2nd Test.	Result.	1st Test.	2nd Test.	Result.	1st Test.	2nd Test.	Result.	1st Test.	2nd Test.	Result.		1st Test.	2nd Test.	Result.	1st Test.	2nd Test.	Result.	1st Test.	2nd Test.	Result.	1st Test.	2nd Test.	Result.		Gas.	Electric.
C.	72	67	−5	37·5	36·5	+1	9	9	...	174	173	− 1	− 5	75	75	...	38·5	37·7	+ ·8	9	9	...	196	198	+ 2	+ 2·8	+ 7·8	...
E.	78	75	−3	53	56·5	−3·5	35	34	+1	116	121	+ 5	− ·5	78	78	...	54·5	55	− ·5	36	36	...	126	129	+ 3	+ 2·5	+ 3	...
I.	83	79	−4	50	49·5	+ ·5	36·5	35	+1·5	93	96	+ 3	+ 1	77	76	−1	48·5	48·5	...	34·5	34·5	...	96	102	+ 6	+ 5	+ 4	...
J.	67	65	−2	67·5	69·5	−2	56	56	...	175	162	−13	−17	63	62	−1	72·5	72	+ ·5	55	54	+1	182	175	− 7	− 6·5	+10·5	...
K.	77	80	+3	56	54·5	+1·5	36	35	+1	125	127	+ 2	+ 7·5	73	76	+3	56	55·5	+ ·5	36·5	35·5	+1	125	136	+ 1	+ 5·5	...	+2
L.	68	65	−3	80·5	80·5	...	37	36	+1	118	124	+ 6	+ 4	65	68	+3	84	83·5	+ ·5	37·5	36·5	+1	121	133	+12	+16·5	+12·5	...
M.	62	59	−3	75	77	−2	48·5	49	− ·5	171	160	−11	−16·5	67	64	−3	75·5	76·5	−1	62	61·3	+ ·5	160	165	+ 5	+ 1·5	+18	...
N.	69	66	−3	60	57·5	+2·5	39	39	...	133	123	−10	−10·5	68	69	+1	56·5	57	− ·5	40	38	+2	123	129	+ 6	+ 8·5	+19	...
O.	75	76	+1	45	46·5	−1·5	9	9	...	179	179	...	− ·5	74	73	−1	45·5	46·5	−1	9	9	...	209	209	...	− 2	...	+1·5
P.	83	79	−4	50	49·5	+ ·5	36·5	35·5	+1	93	96	+ 3	+ ·5	77	76	−1	48·5	48·5	...	34·5	34·5	...	96	102	+ 6	+ 5	+ 4·5	...
																											79·3	+3·5

= Difference in favour of Gas + 75·8.

eight considerable gains with the gas light. Adding up all the advantages gained by the 10 subjects they stand as 79·3 to 3·5, leaving a difference in favour of gas of 75·8 units, which gives an average gain of 7·58 units per man.

It will be seen that all the results point strongly in the same direction, namely, that gas light, as used in these experiments, is less fatiguing to the eye than electric light. The consistent character of the results is very satisfactory, but in view of the great importance of the subject further tests, conducted under conditions more favourable for ophthalmic work, would seem to be desirable.

GENERAL SUMMARY.

1. The whitewash on the walls of the room was able to absorb all the sulphur products of the gas-burning for a period much beyond the investigation: the power would not be exhausted for twenty-five years.

2. The gas and electric burners and supply were arranged to be of normal type, with an ordinary good and equal illumination. The experiments were alternated from room to room, in order to neutralise any difference there might be in the characteristics of the two rooms; and in order to accentuate any effects, the ventilation was mostly restricted to an average of 2,000 c.f. per hour.

3. The changes in the air of the room by the human contributions far exceed those by either illuminant.

4. Carbonic acid *per se*, in quantities up to 50 parts per 10,000, even when of respiratory origin, is not responsible for any physiological effects.

5. Although gas combustion originally develops more heat than electricity does, it was found that the final result was equalised by the following causes:—

a. The gas-burners gave rise to stronger air-currents and invariably produced a more active ventilation and diffusion of air than electric lights; hence, along with the products of the gas-burning, the exhalations from the persons present were more rapidly removed.

b. The ascending currents of air from the gas lights on reaching the ceiling rapidly parted with their heat, which was conducted away by the rafters and joists.

c. The electric lamps really produced more heat than is commonly credited to them.

This seems to be the explanation of the unexpected result that the average temperature of the rooms was practically the same under either illuminant, and that the electric light did not show the superiority in coolness usually claimed.

6. The relative humidity of the air was in general 70 to 75 per cent. during the experiments, and was, therefore, such as the best authorities have laid down as most agreeable. On the score of humidity the use of either illuminant is therefore consistent with correct hygienic conditions.

7. Determinations of the organic matter in the air of the rooms showed that:—

a. The amount was very small and required, for oxidisation, 4 to 18 parts by weight of oxygen per million volumes of air.

b. It increased in quantity in 3 hours in an electrically-lit room in which persons were present, therefore it was, for the most part, a respiratory product.

c. Nineteen hours' gas burning in a room without occupants also gave fairly constant and comparatively high values.

d. There were thus two kinds of organic matter, parallel to the two kinds of carbonic acid, from respiration and combustion.

e. A great part is due to organic dust.

f. The rise in the course of the evening was less with gas than with electric light, probably because the organic matter produced by persons is partially destroyed by the gas.

8. That no appreciable amount of unburnt gas was present in the rooms during the investigation was proved by delicate tests for carbon monoxide, which is a constant constituent of coal gas. Only minute traces were found, in no case reaching ·01 parts per 10,000.

In order to observe the physiological effects of a large leakage, three of the subjects remained in one of the rooms while 8·8 c.f. of gas per hour was intentionally escaping, an excessive amount. The symptoms were observed, and the recovery. The inference from the experiment is that in any quantity of gas likely to escape from an ordinary leakage there is no fear of any immediate danger to health.

9. The bacterial contents of the air of the rooms were less with gas than with electricity, owing to (*a*) Cremation of the organisms in the gas flames; (*b*) Sterilizing effect of the sulphur acids from the gas; (*c*) increased condensation on the surfaces removing organisms, together with sulphur products. As a consequence the condensed moisture under electric light contained a number of living organisms, while that under gas was sterile.

10. As a rule the *Pulse Rate* fell in the interval between the beginning and the end of the experiments, and a greater fall occurred after the room was divided, which was independent of the source of light. All the four series were almost identical at the end of the evening run, and although a slightly lower rate was observed in both periods under the electric light, the figures, as a whole, prove that the difference in the mode of lighting has no influence on the rate of the pulse.

11. *Respiration frequency;* the change in environment due to the altered condition of ventilation and density of population occasioned by the division of the room, caused a greater difference in the respiratory act than change in the mode of lighting.

12. There was an apparent increase in the difference of the *Blood pressures* in the undivided room under gas, but after the room was divided the results obtained under the two lights show no marked difference on hæmanometric readings.

13. *Sphygmographic tracings* and blood pressure determinations indicated generally a slight rise of arterial tone under both kinds of light, but there was more general improvement under gas than under electricity.

14. There is no physiological difference between the two lights affecting the *body temperature*, although this factor is very sensitive to slight alterations in the temperature and humidity of the room.

15. In changes of *body weight* the influence of the two illuminants was too small to affect the result either way.

16. Calculations set to 10 persons at the beginning and end of 13 evenings to ascertain if any *mental fatigue* was occasioned by either mode of illumination, showed that, owing to the subject being comparatively at rest in the interval, a general improvement occurred, electricity giving the greater average gain in speed and also in accuracy. The results distinctly proved that the evening's rest had done more good on the whole under electric light than under gas, but there were more cases under gas in which no change took place.

17. Tests on 9 persons on 5 different occasions after the gas and electric lights had been burning for 3 to 12 hours, showed that neither had affected the air sufficiently to make any certain difference to the sense of smell.

18. With 8 subjects on each of 9 evenings, there was a very slight slowing down of the velocity of transmission of nerve force at the close of the three hours, to a like degree under gas and electric light.

19. In the Ophthalmic experiments:—

a. The sensitiveness of the eye to light as measured in the

Perception test is diminished very markedly after exposure to the electric light, while no corresponding effect is noticeable after the eye has been subjected to the gas light.

b. The power of co-ordinating and using the motor muscles of the eyeball recorded in the orbicular muscle tests was diminished to a greater extent after subjection to electric than to gas light.

c. It was found that the ciliary muscles of the eye are more accommodative after three hours' exposure to the 50-c.p. light from the Darwin incandescent mantle than after a similar exposure to a 50-c.p. electric light.

d. The acuity of vision measured by the retinal test again shows that the optic nerve or centre was more susceptible in the case of gas illumination.

e. The total advantage accruing to the individuals examined shows that there were only two small gains under electric while there were eight considerable gains under gas light. Adding up all the advantages gained by the ten subjects, they stand as 79·3 to 3·5, leaving a difference in favour of gas of 75·8 units, or an average gain of 7·58 units per man.

General Observations on the Results of the Inquiry.

The burning of gas for lighting purposes consumes oxygen and is accompanied by the production of considerable quantities of carbonic acid, water vapour, and other substances, and of twice as much heat as results from an equal illumination by electricity.

If the gas were burnt in an air-tight box, with sides of some non-conducting material, the oxygen would be quickly exhausted, and the products would accumulate to an indefinite extent.

These conditions are not even distantly approached in any actual room, since there is always an active and continuous interchange of air, and heat is freely conducted and radiated through the walls, windows, and ceiling.

By reason of their massive construction, the rooms used for these experiments were more nearly air-tight than any ordinary living room is likely to be, the rate of ventilation through the walls being only one-half of that noted by Pettenkofer in his own house. Notwithstanding this, and the special precautions taken to prevent the ingress of further air, the composition of the air under gas illumination showed no marked difference from that under electricity, and the condition of the room as regards heat was practically the same under both illuminants.

With natural ventilation the proportion of carbonic acid in the air was practically identical for both illuminants.

The ventilating effect of the gas burners has thus proved competent to carry off the whole of their products, or an equivalent amount of the products of respiration.

It is therefore not surprising that the search for the physiological effects of lighting by gas has been in the main a fruitless one.

The fifteen men have been subjected on more than fifty occasions to some 6,000 tests of the kind best calculated to detect any such falling-off in condition as might be expected to take place under either mode of illumination. The results of these tests have been carefully examined and averaged, and, with few exceptions, they absolutely fail to disclose any measurable difference between one mode of lighting and the other. Not only so, but in no case do they show any deviation from any normal conditions. It is not merely that the changes noted were well within the limits of accommodation. If this were all it would be a very poor answer to the question propounded, for it would obviously be unsatisfactory that a system of lighting should trench, no matter how slightly, upon that power of accommodation on which the body depends to safeguard it in the presence of adverse influences. Not only were the limits of accommodation never exceeded, but they were in no case even distantly approached, and the conditions which the physiological tests disclosed were in all cases entirely satisfactory. The differences found between the two lights were so small as to be absolutely devoid of any hygienic significance; they were, in fact, much less than those that are constantly produced in healthy subjects by slight changes in their condition or environment.

Not less important than the negative indication of the statistical results is the fact that fifteen men, after a more or less exacting day's work, were confined for several hours each evening in crowded and scantily ventilated rooms in which the products of gas combustion or the heat from electric lighting were allowed to accumulate to an extent which would hardly be possible in any ordinary living room, that they were under continuous medical observation, and that in no case was there any adverse influence of any kind whatever exerted by the lights or their products. It is true that in the arithmetical tests the mistakes at the end of the evening exceeded those at the beginning, but from a physiological point of view the gain in speed may fairly be regarded as offsetting the loss in accuracy. It was found also by the very delicate optical tests employed that some slight falling-off in visual power took place under the electric light. Any trouble from this cause could, however, be effectually guarded

against by adopting an arrangement of lights suitable for the use to which the room is to be put.

There may be, and doubtless are, persons so peculiarly constituted as to find one light or other objectionable, or even to be unable to tolerate any artificial light whatever. Such cases belong to the domain of pathology rather than that of hygiene. On a review of the whole of the facts collected, it may be said, without reservation, that there is nothing in either mode of lighting which is incompatible with the best hygienic conditions.

The main conclusions may be therefore summed up as follows:—

(1) Owing to the better ventilation obtained by gas, the products of combustion are not found in the air in anything like the proportion which might be expected, the temperature and humidity in an occupied room being no greater than when the room is lit with electric light.

(2) Carbonic acid has not the injurious effect which was formerly attributed to it, but considerable rises in the temperature and moisture content of a room, from whatever source, do have a prejudicial effect upon the well-being of the occupants. Even under adverse conditions of ventilation purposely created for this inquiry, neither the temperature nor percentages of moisture in the room reached a point at which any such effect could be detected by any of the recognised physiological tests.

(3) It has been established that the products, viz., heat, carbonic acid and moisture, so far as they modify the health of the occupants of a room, are derived from the inmates more than from the illuminant, and that a room of moderate size can be efficiently lighted by gas without sensibly affecting the amount of these three factors.

(4) Whilst undoubtedly, it is important to ensure adequate ventilation in domestic rooms, this, with present methods of construction, is better ensured the smaller the room. The problem of securing sufficient ventilation in public rooms of a larger size has been outside the scope of this inquiry.

(5) The medical conclusions are in accord with those arrived at from the chemical and physical data, and also demonstrate that the choice between the two systems of lighting does not depend upon hygienic considerations.

Appendix 1.

PHYSICAL TABLE

COMPARISON OF VENTILATION IN UNDIVIDED ROOM.

GAS ILLUMINATION.

Date 1907	Initial air supply. cu.ft. per hr.	Towards end of run. Persons present.	Respiratory CO2 cu.ft. per hr.	CO2 from Gas. cu.ft. per hr.	Total CO2 made. cu.ft. per hr.	CO2 present Parts in 10,000	Air supply cu.ft. per hr.	Final Air supply cu.ft. per hr.
Restricted Ventilation, Fireplaces and Ventilators closed.								
Jan.18	3,420	7.00	5.60	2.62	8.22	23.5	4,215	2,880
" 22	3,960	6.66	5.33	2.63	7.86	19.8	4,974	4,000
" 24	3,010	7.00	5.60	2.58	8.18	22.6	4,398	4,530
" 30	2,600	6.66	5.93	2.29	9.22	31.3	3,377	2,290
Feb. 1	2,762	6.00	4.80	2.28	7.08	22.6	3,817	3,910
" 11	2,650	8.00	6.40	2.24	8.64	30.1	3,310	2,070
" 12	2,020	7.00	5.60	2.23	7.83	37.8	2,316	2,300
" 13	2,080	9.00	7.20	2.49	9.69	35.3	3,095	2,470
" 14	1,850	8.52	6.82	2.54	9.36	29.2	3,714	4,400
" 15	1,550	9.41	7.53	2.34	9.87	42.4	2,570	3,000
Average.	2,687	7.72	6.18	2.41	8.59	29.6	3,579	3,185
Ratio to Initial supply.	1						1.36	1.23
Natural Ventilation, Fireplaces and Ventilators open.								
Feb.21		8.03	6.42	2.58	9.00	15.6	7,758	
" 22		6.77	5.42	2.97	8.39	13.8	8,831	
Mar. 1		6.00	4.80	2.61	7.41	12.7	8,517	
Average.		6.93	5.55	2.72	8.27	13.9	8,369	

ELECTRIC ILLUMINATION

Date 1907	Initial Air supply. cu.ft. per hr.	Towards end of run. Persons present.	Respiratory CO2 cu.ft. per hr.	CO2 present Parts in 10,000.	Air supply cu.ft. per hr.	Final Air supply cu.ft. per hr.
Jan.17	2,234	7.00	5.60	20.6	2,373	2,864
" 21	1,738	8.00	6.40	30.6	2,388	1,920
" 23	4,340	7.00	5.60	16.2	4,598	5,660
" 25	2,860	7.00	5.60	20.4	3,415	3,340
Feb. 6	3,650	7.40	5.92	19.4	3,844	4,050
" 7	4,320	9.12	7.30	22.5	3,945	4,600
" 8	3,060	9.00	7.20	24.2	3,564	3,800
" 18	1,100	8.00	6.40	26.6	2,807	3,100
Average.	2,913	7.81	6.25	22.6	3,492	3,667
Ratio.	1				1.20	1.26
Feb.25		8.00	6.40	+)12.9	7,191	

+) one determination only.

Appendix 2.

PHYSICAL TABLE

COMPARISON OF VENTILATION IN DIVIDED ROOMS.

GAS ILLUMINATION.

Date 1907.	Room	Initial Towards end of run. Air Supply cu.ft. per hr.	Per-sons pre-sent.	Respira-tory CO_2 cu.ft. per hr.	CO_2 from Gas cu.ft. per hr.	Total CO_2 made cu.ft. per hr.	CO_2 pre-sent parts in 10,000	Air sup-ply. cu.ft. per hr.	Final Air Supply cu.ft. per hr.
Restricted Ventilation - Fireplaces and Ventilators open.									
Mar.14	6	1760	6.00	4.8	1.83	6.63	38.3	1874	2300
" 15	4	991	7.25	5.8	1.63	7.43	41.8	1965	2400
" 18	6	1592	7.00	5.6	1.60	7.20	34.2	2384	2400
" 20	4	1013	9.00	7.2	1.61	8.81	51.6	1851	2050
	6	1319	6.63	5.3	1.61	6.91	39.9	1925	1800
Aver-age.		1338	7.18	5.74	1.62	7.36	41.2	2002	2230
Ratio to Ini-tial supply		1	7					1.5	1.67
Natural Ventilation - Fireplaces and Ventilators open.									
Mar.22	6		7.00	5.6	1.74	7.34	16.5	5872	
" 25	4		8.00	6.4	1.44	7.84	22.3	4284	4120
Aver-age.			7.50	6.0	1.59	7.59	19.4	5078	
Increased Ventilation - Fire Places, Ventilatpre and Doors open: Windows open 6 inches at top.									
Mar.26	6		7.00	5.6	1.44	7.04	8.4	16000	
" 27	4		8.00	6.4	0.86	7.26	9.0	14520	
Aver-age.			7.50	6.0	1.15	7.15	8.7	15260	
Ventilators and Baize Doors open: Windows open 2 inches at top. Fires burning.									
Mar.28	6		6.00	4.8	1.54	6.34	8.0	15850	

ELECTRIC ILLUMINATION.

Date 1907.	Room	Initial Air Supply cu.ft. per hr.	Towards end of run. Per-sons pre-sent.	Respira-tory CO_2 cu.ft. per hr.	CO_2 pre-sent parts in 10,000	Air sup-ply. cu.ft. per hr	Final Air Supply cu.ft. per hr.
Mar.8	6	1118	3.00	2.4	17.9	1727	2000
" 12	6	1505	6.13	4.9	24.	2425	1500
" 14	4	1540	7.00	5.6	32.2	1965	1950
" 15	6	1614	6.66	5.3	27.1	2294	2350
" 18	4	905	7.41	5.93	36.6	1814	2185
" 19	6	2196	7.36	5.84	30.9	2170	2300
	4	800	7.96	6.37	49.1	1418	1450
" 21	6	1720	6.00	4.80	31.1	1771	2380
Average		1445	6.43	5.14	31.1	1966	2016
Ratio.						1.37	1.41
Mar.22	4		6.83	5.46	17.8	3966	
" 25	6		7.42	5.93	20.8	3830	
Aver-age.			7.12	5.70	19.3	3748	
Mar.26	6		7.00	5.6	8.4	12720	
" 27	4		8.00	6.4	6.0	21336	
Aver-age.			7.50	6.0	7.2	17027	
Mar.28	4		8.00	6.4	8.4	14500	

PHYSICAL TABLE

TEMPERATURE IN UNDIVIDED ROOM.

GAS ILLUMINATION.

Date.	Period H. m.	Outer Air.			Average Room.			Room above Outer Air.		
		1st.	Last	Change	1st.	Last	Change	1st.	Last	Change
Jan.1	3. 0	49.0	49.5	+ .5	53.0	57.0	+4.0	4.0	7.5	+3.5
" 8	3. 0	45.6	45.1	- .5	55.76	57.84	+2.08	10.16	12.74	+2.58
" 14	3. 0	47.25	45.95	-1.3	54.99	57.05	+2.06	7.74	11.10	+3.36
" 18	3. 0	40.8	40.4	- .4	49.3	57.1	+7.8	8.5	16.7	+8.2
" 22	3.30	33.2	32.0	-1.2	46.6	52.9	+6.3	13.4	20.9	+7.5
" 24	3.30	31.1	31.5	+ .4	*49.2	53.8	+4.6	18.1	22.3	+4.2
" 26	3. 0	44.1	46.0	+1.9	49.8	52.2	+2.7	5.4	6.2	+ .8
" 29	3.30	40.1	38.5	-1.6	49.3	53.3	+4.0	9.2	14.8	+5.6
" 30	3.30	39.0	36.8	-2.2	*51.6	57.8	+6.2	12.6	21.0	+8.4
" 31	3.30	38.4	37.5	- .9	*51.8	57.3	+5.5	13.4	19.8	+6.4
Feb.1	3. 0	36.8	35.9	- .9	*50.2	56.2	+6.0	13.4	20.3	+6.9
" 11	3.30	42.0	38.9	-3.1	*57.6	58.2	+0.6	15.6	19.3	+3.7
" 12	3.30	45.9	45.4	- .5	*55.3	58.1	+2.8	9.4	12.7	+3.3
" 13	3. 0	41.3	40.3	-1.0	*54.2	57.3	+3.1	12.9	17.0	+4.1
" 14	3.30	41.1	41.3	+ .2	*53.43	57.0	+3.57	12.33	15.7	+3.37
" 18	3.30	43.0	46.5	+3.5	*54.89	58.84	+3.95	11.89	12.34	+ .45
" 19	2. 0	47.05	48.3	+1.25	*56.27	57.98	+1.71	9.22	9.68	+ .46
" 21	3. 0	41.5	39.0	-2.5	*54.95	56.37	+1.42	13.45	17.37	+3.92
" 22	3. 0	37.3	35.4	-1.9	*57.03	57.15	+ .12	19.73	21.75	+2.02
" 27	3. 0	45.5	44.2	-1.3	°61.34	62.21	+ .87	15.84	18.01	+2.17
Mar.1	3.0	48.5	45.4	-3.1	58.69	60.74	+2.05	10.19	15.34	+5.15
Average of all.		41.83	41.13	-0.70	53.57	56.97	+3.40	11.74	15.84	+4.10
Average omitting Humidity night.		41.65	40.98	-0.67	53.16	56.71	+3.53	11.63	16.73	+4.30

ELECTRIC ILLUMINATION.

Date	Period H. m.	Outer Air.			Average Room.			Room above Outer Air.		
		1st.	Last	Change	1st.	Last	Change	1st.	Last	Change
Jan.3	3. 0	41.5	39.5	-2.0	48.7	54.5	+5.8	7.2	15.0	+7.8
" 7	3. 0	44.05	44.9	+ .85	52 9	55.1	+2.2	8.85	10.2	+1.35
" 9	3. 0	46.3	45.8	- .5	55.68	58.16	+2.48	9.38	12.36	+2.98
" 11	3. 0	43.0	41.7	-1.3	53.24	58.39	+5.15	10.24	16.69	+6.45
" 15	3. 0	46.7	47.0	+ .3	55 60	57.69	+2.09	8.90	10.69	+1.79
" 16	2.30	47.4	47.0	- .4	56.8	58.5	+1.7	9.4	11.5	+2.1
" 17	3. 0	45 15	43.2	-1.95	53 7	57 7	+4.0	8.55	14.5	+5.95
" 21	3.30	42.0	40.4	-1.6	50.3	55.7	+5.4	8.3	15.3	+7.0
" 23	2.30	29.95	29.8	- .15	48.3	50.3	+2.0	18.35	20.5	+2.15
" 26	4.0	32.5	32.3	- .2	48.5	54.2	+5.7	16.0	21.9	+5.9
Feb.4	3.30	35.95	35 6	- .35	50 5	54.8	+4.3	14.55	19.2	+4.65
" 5	3. 0	37.7	37.55	- .15	51.0	55.8	+4.8	13.3	18.25	+4.95
" 6	3. 0	38.1	37.2	- .9	54 5	57.9	+3.4	16 4	20.7	+4.3
" 7	3. 0	36.2	34.2	-2.0	52.7	56.8	+4.1	16.5	22.6	+6.1
" 8	3.30	37.7	36.1	-1.6	51.5	57.2	+5.7	13.8	21.1	+7.3
" 18	3.30	48.4	47.8	- .6	55.88	58.42	+2.54	7.48	10.62	+3.14
" 25	3. 0	46.0	44.7	-1.3	58.31	58 06	- .25	12.31	13.36	+1.05
" 26	3.50	45.0	44.6	- .4	51.41	50.46	- .95	16.41	15.86	- .55
" 28	2.30	44.0	43.2	- .8	55.64	56.72	+1.08	21.64	23.52	+1.88
Average of all.		41.46	40.66	-0.80	53.96	57.18	+3.22	12.50	16.52	+4.02
Average omitting Humidity night.		41.09	40.28	-0.81	52.83	56.42	+3.59	11.74	16.14	+4.40

*Heater on in afternoon.
x " " evening
°Humidity experiment

Appendix 4

PHYSICAL TABLE

TEMPERATURE IN DIVIDED ROOM.

GAS ILLUMINATION. ELECTRIC ILLUMINATION.

Date.	Room No.	Period H. m.	Outer Air. 1st.	Last	Change	Average Room 1st.	Last	Change	Room above outer air. 1st.	Last	Change	Date.	Room No.	Period H. m.	Outer Air. 1st.	Last	Change	Average Room. 1st	Last	Change	Room above Outer Air. 1st.	Last.	Change
Restricted Ventilation - Fireplaces and Ventilators closed.																							
Mar.11	6	3. 0	39.4	37.6	-1.8	54.39	59.34	+4.95	14.99	21.74	+6.75	Mar.11	4	3. 0	39.4	37.6	-1.8	55.09	60.05	+4.96	15.69	22.45	+6.76
" 12	4	3. 0	43.8	42.8	-1.0	56.55	60.85	+4.30	12.75	18.05	+5.30	" 12	6	3. 0	43.8	42.8	-1.0	57.92	60.31	+2.39	14 12	17.51	+3.39
" 14	6	3. 0	45.1	44.3	- .8	59.83	63.84	+4.01	14.73	19.54	+4.81	" 14	4	3. 0	45.1	44.3	- .8	58.16	62.48	+4.32	13.06	18.18	+5.12
" 15	4	3.30	51.8	52.4	+ .8	61.17	66.46	+5.29	9.57	14.06	+4.49	" 15	6	3.25	51.6	52.4	+ .8	60.76	65.52	+4.54	9.18	12.92	+3.74
" 18	6	3. 0	52.1	48.3	-3.8	61.9	64.71	+2.81	9.80	16.41	+6.61	" 18	4	3. 0	52.1	48.3	-3.8	58.95	63.56	+4.61	6.85	15.26	+8.41
" 19	4	3. 0	52 1	50.4	-1.7	60.01	65.27	+5.26	7.91	14.87	+6.96	" 19	6	3. 0	52.1	50.4	-1.7	61.42	65.86	+4.44	9.32	15.46	+6.14
Aver-age			47.35	45.97	-1.38	58.98	63.41	+4.43	11.63	17.44	+5.81	Aver-age.			47.55	45.97	-1.58	58.72	62.93	+4.21	11.37	16.96	+5.59
Humidity Experiments.																							
Mar.20	4	3. 0	51.0	47.0	-4.0	64.64	67.46	+2.82	13.64	20.46	+6.82												
	6	3. 0				64.78	67.16	+2.44	13.72	20.16	+6.44												
Aver-age.						64.78	67.31	+2.53	13.78	20.31	+6.53	Mar.21	4	3. 0	53.1	48.4	-4.7	65.21	67.35	+2.14	12.11	18.95	+6.84
Mar.21						129,86	134.68	5.06	27.56	40.62	13.06	"	6	3. 0				65.08	67.42	+2.41	11.98	19.08	+7.11
												Averg						65.14	67.42	+2.28	12.04	19 03	+6.99
Natural Ventilation - Fireplaces and Ventilators open																							
" 22	6	3. 0	51.8	47.2	-4.6	61.71	65.34	+3.63	9.91	18.14	+8.23	Mar.22	4	3.0	51.8	47.2	-4.6	59.58	62.61	+3.83	7.78	15.61	7.83
" 25	4	3. 0	49.3	47.8	-1.5	59.99	62.51	+2.52	10.69	14.71	+4.02	" 25	6	3.0	49.3	47.8	-1.5	58.88	62.59	+3.71	9.58	14.79	5.21
Aver-age.			50.56	47.50	-3.06	60.85	63.92	+3.07	10.30	16.42	+6.12	Aver-age.			50.56	47.50	-3.06	59.23	62.70	+3.47	8.68	15.20	+6.52
Increased Ventilation - Fireplaces, Ventilators and Doors open; Windows open 6 inches at top.																							
Mar.26	6	3. 0	50.3	47.7	-2.6	59.30	59.03	- .27	9.0	11.33	+2.33	Mar.26	4	3. 0	50.3	47.7	-2.6	58.92	57.92	-1.00	8.62	10.22	1.60
" 27	4	2.30	53.3	49.2	-4.1	57.89	56.06	-1.83	4.26	6.86	+2.57	" 27	6	2.30	53.3	49.2	-4.1	57.63	55.81	-1.82	4.33	6.61	2.28
Aver-age.			51.80	48.45	-3.35	58.44	57.54	-0.90	6.64	9.09	+2.45	Aver-age.			51.80	48.45	-3.35	58.27	56.86	-1.41	6.47	8.41	+1.94
Ventilators & Baize Doors open - Windows open 2 inches at top, Fires burning.																							
Mar.28	6	2.30	53.2	50.0	-3.2	70.31	74.0	+3.69	17.11	24.0	+6.89	Mar.28	4	2.30	53.2	50.0	-3.2	68.76	71.11	+2.33	15.56	21.11	5.55

Appendix 5

PHYSICAL TABLE

HUMIDITY IN UNDIVIDED ROOMS.

Gas Illumination.

Date.	Outer Air.				In Room.										
	Dry Bulb	Dry-wet	Grains per c.f.	Rum.	Dry Bulb.			Dry-wet		Grains per c.f.		Grains in room.		Humidity.		
					1st.	last	rise	1st.	last	1st.	last	1st.	last	1st.	last	Ch.
Jan. 2	41.8	2.7	2.42	79	52.8	57.8	4.5	3.5	2.5	3.48	4.38	17400	21900	4500	78	84	+ 6
" 8	45.7	3.0	2.75	78	55.8	58.8	2.2	2.8	2.7	4.10	4.48	20500	22400	1900	82	84	+ 2
" 14	47.8	3.7	2.87	75	55.0	57.0	2.0	3.7	3.0	3.75	4.25	18750	21250	2500	77	81	+ 4
" 18	39.5	0.5	2.68	96	48.7	57.4	8.7	2.2	3.6	3.33	4.11	16650	20550	3900	88	78	- 7
" 22	31.0	2.0	1.50	72	47.8	53.2	5.4	4.8	4.4	2.61	3.51	13050	16500	3500	69	73	+ 4
" 24	28.2	2.8	1.56	86	49.3	53.3	4.0	4.2	4.9	2.80	3.20	14500	16000	1500	73	70	- 3
" 28	47.0	2.2	3.12	84	49.5	51.9	2.4	2.3	2.2	3.36	3.72	16900	18600	1700	84	85	+ 1
" 29	42.0	4.0	2.28	70	49.6	53.5	3.5	4.2	3.5	2.97	3.58	14850	17900	3050	73	78	+ 5
" 30	39.8	4.6	1.88	85	51.6	57.1	5.5	5.3	4.3	2.92	3.88	14600	19400	4800	67	74	+ 7
" 31	38.8	2.7	2.13	78	51.4	56.8	5.4	4.9	4.5	2.99	3.79	14950	18950	4000	69	75	+ 6
Feb. 1	36.0	2.0	2.01	82	50.9	55.9	5.0	4.4	4.4	3.05	3.85	15250	18400	3150	72	73	+ 1
" 11	42.8	3.2	1.99	83	57.5	58.6	1.1	5.7	4.6	3.58	4.01	17900	20050	2150	67	73	+ 6
" 12	47.2	1.1	3.40	92	55.1	57.8	2.7	3.7	3.0	3.78	4.37	18900	21850	2950	77	82	+ 5
" 13	41.0	2.7	2.35	79	54.7	57.1	2.4	4.2	3.6	3.59	4.14	17950	20700	2750	74	79	+ 5
" 14	43.2	3.7	2.37	75	53.8	57.1	3.3	5.0	4.0	3.22	3.97	16100	19850	3750	69	75	+ 6
" 15	49.5	1.2	3.38	92	55.1	58.7	3.6	3.0	2.7	3.97	4.61	19850	23050	3200	81	93	+ 8
" 19	46.0	1.2	3.25	91	56.1	57.9	2.8	3.5	3.1	3.97	4.34	19850	21700	1850	78	81	+ 3
" 21	41.2	4.1	2.08	69	55.1	56.4	1.3	5.0	4.6	3.41	3.70	17050	18500	1450	70	72	+ 2
" 22	36.8	4.0	1.71	87	57.5	57.9	0.4	6.3	6.1	3.43	3.53	17150	17650	500	64	65	+ 1
Mch. 1	52.0	3.2	3.23	73	60.2	61.6	0.4	5.1	5.2	4.09	4.28	20450	21400	950	70	70	Nil
Avge.	41.63	2.788	2.46	78.2	53.36	56.709	+3.34	4.19	3.83	3.45	3.97	17150	19850	+2700	73.9	76.6	+2.7
	Special Humidity Experiments.																
Feb.27	47.5	3.6	2.85	76	51.5	52.5	+1.0	3.5	3.5	4.81	4.99	24050	24950	+940	79	79	Nil

Electric Illumination.

Date.	Outer Air				In Room.										
	Dry Bulb	Dry-wet	Grains per c.f.	Rum	Dry Bulb			Dry-wet		Grains per c.f.		Grains in room.		Humidity.		
					1st.	last	rise	1st.	last	1st.	last	1st.	last	1st.	last	Change
Jan. 3	42.8	3.2	2.34	75	48.5	54.5	5.7	4.5	4.0	2.79	3.6	13950	18000	4050	71	75	+ 4
" 7	45.4	1.4	3.12	90	52.9	54.9	2.0	3.0	2.8	3.66	4.00	18300	20000	1700	81	82	+ 1
" 9	47.0	3.8	2.90	78	53.0	56.2	2.2	3.9	3.2	3.90	4.32	19500	21600	2100	77	80	+ 3
" 11	48.0	3.8	2.80	75	57.3	58.8	1.5	3.8	3.7	4.01	4.31	20300	21550	1250	77	78	+ 1
" 15	47.0	3.8	2.75	74	55.7	57.4	1.7	4.3	3.8	3.85	4.17	19250	20850	1600	73	79	+ 6
" 16	47.1	4.1	2.69	72	57.1	58.5	1.4	4.0	3.8	3.97	4.23	19850	21150	1300	75	77	+ 2
" 17	47.0	4.2	2.63	70	54.2	57.6	3.4	4.6	4.1	3.40	4.0	17000	20000	3000	72	75	+ 3
" 21	46.4	2.4	2.90	88	50.8	55.5	4.7	3.3	3.0	3.30	4.04	16500	20200	3700	78	81	+ 3
" 23	28.6	1.6	1.36	74	48.9	51.0	2.1	4.5	4.9	2.80	2.95	14000	14750	750	71	69	- 2
" 25	33.6	3.2	1.58	89	48.2	53.6	5.4	4.9	4.7	2.64	3.28	13200	16400	3200	68	71	+ 3
Feb. 4	34.1	1.1	2.06	88	50.0	54.1	4.1	4.4	4.2	2.94	3.49	14700	17450	2750	72	74	+ 2
" 5	36.8	1.6	2.17	86	50.8	54.9	4.1	4.0	3.6	3.14	3.71	15700	18550	2850	74	76	+ 2
" 6	37.8	3.3	1.92	75	54.9	57.0	2.1	5.7	5.3	3.22	3.61	16100	18050	1950	66	68	+ 2
" 7	37.1	3.8	1.77	69	52.8	56.5	3.7	5.0	4.7	2.89	3.70	14450	18500	4050	64	71	+ 7
" 8	39.0	2.9	2.10	76	51.6	56.6	5.1	5.5	5.1	2.88	3.60	14300	18000	3700	66	69	+ 3
" 18	49.8	3.6	3.09	76	55.7	58.1	2.4	3.6	3.1	3.87	4.37	19350	21850	2500	78	81	+ 3
" 25	49.0	2.3	3.33	84	58.3	58.4	0.1	4.5	4.2	4.03	4.09	20150	20450	300	73	73	+ 2
Avge.	41.886	2.910	2.43	77.1	53.179	56.210	+3.049	4.34	4.01	3.35	3.85	16750	19250	+2500	72.7	75.35	+2.65
Feb.26	43.2	1.2	2.93	91	51.1	50.9	-0.2	2.8	3.5	4.97	4.70	23500	21850	1350	83	79	- 4
" 28	46.0	3.2	3.00	78	55.7	56.8	1.1	3.8	2.8	5.67	6.06	28350	30300	1950	82	84	+ 2
Avge.	45.6	2.2	2.96	84	53.4	53.85	+0.45	3.0	3.15	5.32	5.38	26925	27675	+1650	82.5	81.5	-1

Appendix 6.

PHYSICAL TABLE

HUMIDITY IN DIVIDED ROOMS.

Date 1907	Outer Air. Dry Bulb	Dry-wet	Grains per c.f.	Humidity %	Room	In gas lit room. Dry bulb therm. 1st.	last	change	Dry-wet. 1st.	last	Grains per c.f. 1st.	last.	Grains in room. 1st.	last.	change	Humidity. 1st.	last.	change	Room	In electric lit room. Dry bulb therm. 1st.	last	change.	Dry-wet 1st.	last	Grains per c.f. 1st.	last	Grains in room. 1st.	last.	change	Humidity. 1st.	last	change.
Restricted Ventilation - Fireplaces & Ventilators closed.																															
Mar.7	45.1°	41°	3.16	92	6	58.0°	58.6°	+0.6°	5.0°	5.0°	3.82	4.32	9,550	10,800	+1,250	70%	79%	+9%	4	52.8	58.7	+5.9	3.1	3.7	3.64	4.28	9,100	10,700	+1,600	80	78	-2
" 11	40.0	3.7	2.05	71	6	54.0	60.0	+6.0	5.0	5.0	3.26	4.10	8,150	10,250	+2,100	69	71	+2	4	55.3	60.8	+5.5	3.1	4.4	3.87	4.40	8,925	11,000	+2,075	85	74	+5
" 12	44.9	5.1	2.25	65	4	57.3	61.7	+4.4	5.7	6.0	3.58	4.35	8,875	10,875	+2,000	66	71	+5	6	57.5	60.5	+3.0	4.5	5.5	3.68	4.56	9,700	10,225	+ 525	73	68	-5
" 14	45.7	4.6	2.53	80	6	60.2	64.0	+3.8	5.2	5.5	4.07	4.62	10,175	11,550	+1,375	70	69	-1	4	58.8	62.8	+4.0	5.7	4.8	3.76	4.62	9,400	11,550	+2,150	67	72	+5
" 15	51.4	6.9	4.02	94	4	61.8	66.9	+5.1	3.8	4.0	4.77	5.54	11,925	14,100	+2,175	78	77	-1	5	61.0	65.0	+4.0	4.3	4.3	4.45	5.18	11,125	12,950	+1,825	75	76	+1
" 18	54.3	4.5	3.45	72	6	62.0	65.0	+3.0	5.0	5.0	4.43	4.95	11,050	12,375	+1,325	71	72	+1	4	59.5	63.9	+4.4	5.4	4.4	3.93	4.97	9,825	12,425	+2,600	88	75	+6
" 19	52.5	4.2	3.23	73	4	60.8	65.7	+4.9	5.8	5.3	4.05	4.95	10,000	12,375	+2,375	67	71	+4	5	58.0	66.0	+8.0	5.0	5.0	4.14	5.12	10,350	12,800	+2,450	67	78	+5
Aver.	47.8	5.44	2.96	76.6		59.16	63.11	+3.95	5.07	4.76	3.98	4.70	9,950	11,750	+1,800	70.1	72.9	+2.8	Av.	56.27	62.53	+4.26	4.87	4.59	3.91	4.67	9,775	11,675	+1,900	71.4	73.6	+2.2
Humidity Experiments. (Restricted Ventilation).																															
Mar20	53.0	5.2	3.10	68	4	55.2	57.7	+2.5	4.4	4.7	3.18	3.52	12,950	13,800	+ 850	75	74	-1													
					6	55.0	57.0	+2.0	5.0	4.6	4.98	5.48	12,375	13,700	+1,325	72	75	+3													
" 21	56.8	6.6	3.28	82															4	55.8	57.7	+1.9	3.0	3.1	5.80	6.12	14,500	15,300	+ 800	83	82	-1
																			6	55.2	57.0	+1.8	2.3	2.8	5.97	6.17	14,925	15,425	+ 500	87	85	-2
Aver.						55.10	57.35	+2.25	4.7	4.6	5.06	5.50	12,660	13,750	+1,090	73.5	74.5	+1	Av.	55.50	57.35	+1.85	2.6	2.85	5.88	6.14	14,700	15,350	+ 650	85	83.5	-1.5
Natural Ventilation - Fireplaces & Ventilators open.																															
Mar.22	54.6	5.6	3.73	77	6	62.5	66.0	+3.5	5.9	6.0	4.25	4.79	10,625	11,975	+1,350	67	68	+1	4	60.3	63.8	+3.5	4.9	5.4	4.18	4.62	10,450	11,550	+1,100	71	70	-1
" 25	53.8	4.8	3.38	72	4	60.7	63.1	+2.4	4.7	4.9	4.29	4.64	10,725	11,600	+ 875	72	72	0	6	59.0	62.3	+3.3	5.0	5.1	3.96	4.43	9,900	11,075	+1,175	71	71	0
Aver.	54.2	4.1	3.54	74.5		61.60	64.55	+2.95	5.3	5.45	4.27	4.71	10,675	11,775	+1,100	69.5	70	+0.5	Av.	59.65	63.05	+3.40	4.95	5.25	4.07	4.53	10,175	11,300	+1,125	71.0	70.5	-0.5
Increased Ventilation - Fireplaces, Ventilators & Doors Open - Windows open 6 inches at top.																															
Mar.26	53.0	3.1	3.55	80	6	59.0	58.5	-0.5	5.0	5.7	3.71	3.72	9,275	9,300	+ 25	66	67	+1	4	59.4	57.8	-1.6	4.9	5.0	4.04	3.76	10,100	9,450	- 650	71	70	-1
" 27	55.8	4.8	3.71	71	4	57.8	56.2	-1.6	5.4	6.0	3.46	3.32	8,650	8,300	- 350	64	65	+1	6	57.5	55.3	-2.2	7.0	6.7	3.26	3.27	8,150	8,175	+ 25	61	66	+5
Aver.	54.9	3.95	3.63	75.5		58.40	57.35	-1.05	5.20	5.85	3.58	3.52	8,950	8,800	- 150	65	66	+1	Av.	58.45	56.55	-1.90	5.95	5.35	3.65	3.52	9,125	8,800	- 325	66	68	+2
Ventilators & Baize Doors open, Windows open 2 inches at top. Fire burning.																															
Mar.28	61.8	7.0	3.65	82	6	69.0	73.0	+4.0	8.0	9.8	4.70	4.85	11,750	12,150	+ 400	61	55	-6	4	69.6	73.6	+4.0	10.3	12.4	4.13	4.20	10,325	10,500	+ 175	52	47	-5
General Averages, excluding Humidity Experiments and Evening with Fires.																															
	50.24	43.66	3.19	76.0		59.46°	62.33°	+2.87°	5.32°	5.06°	3.96	4.49	9,900	11,225	+1,325	69.1	71.1	+2.0		56.56°	61.54°	+2.98°	5.08°	4.85°	3.89	4.43	9,725	11,075	+1,350	70.4	72.0	+1.6

Appendix 7.

2ND. SERIES - OBSERVATIONS ON BODY

Temperatures, taken in the mouth. Recorded in Degrees Fahrenheit.

1907. Date.	Gas Light. Subjects	Room No.	Time before observing	Temperature. 1st. Obsr.	2nd. Obsr.	Differ- ence	Electric Light. Subjects	Room No.	Time before observing	Temperature. 1st. Obsr.	2nd. Obsr.	Differ- ence
			Hrs.m.						Hrs.m.			
Mch. 7	Mr.C.	6	3.15	98·6	97·2	- 1·4	Mr.E.	4	3.15	98·4	97·0	- 1·4
" "	" I.	"	" "	99·1	98·0	- 1·1	" J.	"	" "	98·8	98·4	- 0·4
" 8	Mr. J.	4	2.15	99·7	98·4	- 1·3	Mr.C.	6	2.15	98·1	97·6	- 0·6
" "	"	"	"	"	"	"	Mr.I.	"	" "	98·7	97·6	- 1·1
" 11	Mr.K.	6	3.15	99·2	97·9	- 1·3	Mr.E.	4	3.15	98·4	97·2	- 1·2
" "	" O.	"	" "	99·8	98·0	- 1·8	" J.	"	" "	99·0	98·3	- ·7
" "	" P.	"	" "	98·6	97·1	- 1·5	" L.	"	" "	99·2	98·3	- 0·9
" "	"	"	"	"	"	"	" M.	"	" "	98·6	98·1	- 0·5
" "	"	"	"	"	"	"	" N.	"	" "	99·2	98·3	- 0·9
" 12	Mr.J.	4	3.0	98·9	97·9	- 1·0	Mr.C.	6	3.0	98·2	97·1	- 1·1
" "	" L.	"	" "	99·1	98·4	- 0·7	" I.	"	" "	98·5	97·4	- 1·1
" "	" M.	"	" "	99·0	98·4	- 0·6	" K.	"	" "	98·4	98·1	- 0·3
" "	" N.	"	" "	99·9	99·0	- 0·9	" P.	"	" "	98·4	98·2	- 0·2
" "	"	"	"	"	"	"	" O.	"	" "	99·4	98·5	- 0·9
" 14	Mr.C.	6	3.0	98·1	96·6	- 1·5	Mr.E.	4	3.0	97·9	98·0	- 0·1
" "	" I.	"	" "	98·6	97·8	- 0·8	" J.	"	" "	99·8	98·0	- 1·8
" "	" K.	"	" "	99·2	98·1	- 1·1	" L.	"	" "	98·9	98·4	- 0·5
" "	" O.	"	" "	97·9	97·4	- 0·5	" M.	"	" "	99·1	98·1	- 1·0
" "	" P.	"	" "	98·3	97·8	- 0·5	" N.	"	" "	98·6	98·4	- 0·4
" 15	Mr.E.	4	3.15	98·4	98·4	Nil.	Mr.I.	6	3.15	98·6	97·5	- 1·1
" "	" J.	"	" "	98·8	97·8	- 1·0	" K.	"	" "	98·4	98·5	+ 0·1
" "	" L.	"	" "	98·2	98·4	+ 0·2	" O.	"	" "	97·7	97·8	+ 0·1
" "	" M.	"	" "	99·4	98·4	- 1·0	" P.	"	" "	98·3	97·7	- 0·6
" "	" N.	"	" "	99·0	98·6	- 0·4	"	"	"	"	"	"
" 18	" C.	6	3.0	98·2	97·4	- 0·8	Mr.E.	4	3.0	98·4	97·8	- 0·6
" "	" I.	"	" "	98·6	97·3	- 1·3	" J.	"	" "	99·0	98·3	- 0·7
" "	" K.	"	" "	99·3	98·3	- 1·0	" L.	"	" "	98·8	98·4	- 0·4
Mch.19	Mr.O.	6	3.0	99·2	99·1	- 0·1	Mr.M.	4	3.0	99·1	98·3	- 0·8
" "	" P.	"	" "	98·2	98·4	+ 0·2	" N.	"	" "	98·8	98·4	- 0·4
" 19	Mr.E.	4	3.0	98·5	98·3	- 0·2	Mr C.	6	3.0	98·6	97·0	- 1·6
" "	" J.	"	" "	99·9	98·4	- 1·5	" I	"	" "	98·9	97·0	- 1·9
" "	" L.	"	" "	99·0	98·2	- 0·8	" K	"	" "	98·4	98·3	- 0·1
" "	" M.	"	" "	98·4	98·2	- 0·2	" O.	"	" "	98·6	98·2	- 0·4
" "	" N.	"	" "	98·4	98·4	Nil	" P.	"	" "	98·3	98·2	- 0·1
" 20	Mr.C.	6	3.0	98·7	97.0	- 1·7	Mr.J.	4	3.0	99·1	98.0	- 1·1
" "	" I.	"	" "	98.5	97·2	- 1·3	" L.	"	" "	98·5	98·3	- 0·3
" "	" K.	"	" "	98·3	97·6	- 0·7	" M.	"	" "	98·9	98·5	- 0·4
" "	" O.	"	" "	99·8	99·5	- 0·3	" N.	"	" "	98·4	98·3	- 0·1
" "	" P.	"	" "	97·8	97·6	- 0·2	"	"	"	"	"	"
" 21	Mr.E.	4	3.0	98·4	97·6	- 0·8	Mr.C.	6	3.0	98·4	97·4	- 1·0
" "	" J.	"	" "	99·1	98·3	- 0·8	" I.	"	" "	98·6	97·8	- 0·8
" "	" L.	"	" "	99·1	98·3	- 0·8	" K.	"	" "	98·7	98·1	- 0·6
" "	" M.	"	" "	99·2	97·8	- 1·4	" O.	"	" "	99·4	99·2	- 0·2
" "	" N.	"	" "	98·6	98·5	- 0·1	" P.	"	" "	98·2	97·7	- 0·5
" 22	Mr.K.	6	3.15	98·3	97·6	- 0·7	Mr.E.	4	3.15	98·4	97·5	- 0·9
" "	" O.	"	" "	99·1	98·4	- 0·7	" J.	"	" "	98·0	97·8	- 0·2
" "	" P.	"	" "	97·7	97·3	- 0·4	" L.	"	" "	98·4	98·5	+ 0·1
" "	"	"	"	"	"	"	" M.	"	" "	98·8	98·4	- 0·4
" "	"	"	"	"	"	"	" N.	"	" "	98·7	98·4	- 0·3
" 25	Mr.E.	4	3.0	98·3	98·2	- 0·1	Mr.C.	6	3.0	98·4	97.0	- 1·4
" "	" J.	"	" "	98·6	98·2	- 0·4	" I.	"	" "	98·0	97·6	- 0·9
" "	" L.	"	" "	98·8	97·3	- 1·5	" K.	"	" "	98·5	98·3	- 0·2
" "	" M.	"	" "	98·9	97·8	- 1·1	" O.	"	" "	98·1	98·1	Nil.
" "	" N.	"	" "	98·7	98·2	- 0·5	" P.	"	" "	98·1	98·0	- 0·1
" 26	Mr.C.	6	3.0	98·4	97·1	- 1·3	Mr.E.	4	3.0	98·5	97·4	- 1·1
" "	" I.	"	" "	98·7	97·4	- 1·3	" J.	"	" "	98·6	98.0	- 0·6
" "	" K.	"	" "	99·3	98·9	- 0·4	" L.	"	" "	98·5	98·0	- 0·5
Mch. 26	Mr.O.	6	3.0	98·3	98·0	- 0·3	Mr.M.	4	3.0	98·8	97·6	- 1·2
" "	" P.	"	" "	98·2	98·4	+ 0·2	" N.	"	" "	98·2	98·5	+ 0·3
" 27	Mr.L.	4	3.0	98·7	97·8	- 0·9	Mr.C.	6	3.0	98·4	97.0	- 1·4
" "	" M.	"	" "	99·3	97·1	- 2·2	" I.	"	" "	98·5	97·4	- 1·1
" "	" N.	"	" "	98·4	97·2	- 1·2	" K.	"	" "	98·6	98·3	- 0·3
" "	"	"	"	"	"	"	" O.	"	" "	98·1	97·8	- 0·3
" "	"	"	"	"	"	"	" P.	"	" "	98·2	98·2	Nil.
" 28	Mr.C.	6	3.10	98·2	97·9	- 0·3	Mr.J.	4	3.10	98·8	98·3	- 0·5
" "	" I.	"	" "	98·9	98·0	- 0·9	" L.	"	" "	98·4	98·2	- 0·2
" "	" K.	"	" "	98·4	98·1	- 0·3	" M.	"	" "	98·8	98·2	- 0·6
" "	" O.	"	" "	98·7	98·0	- 0·7	" N.	"	" "	99·2	98·1	- 1·1
" "	" P.	"	" "	98·2	98·1	- 0·1	"	"	"	"	"	"

Gas in both Rooms.

Electric Light in both Rooms.

	1st. Obs.	2nd. Obs.		1st. Obs.	2nd Obs.
Total	5923.7	5872.8		6006.7	6563.6
Average for			Average for		
60 subjects	98.7	98.0	67 subjects	98.3	97.9

Loss = 0.7°F. Loss = 0.7°F.

Appendix B

2nd. SERIES. Observations on Body Weights & weight loss, in Pounds Avoirdupois.

1907	Gas Light.						Electric Light.					
Date.	Subjects	Room No.	Time between observing.	Body weight. 1st. Wt.	Body weight. 2nd. Wt.	Wt. lost.	Subjects	Room No.	Time between observing.	Body weight. 1st. Wt.	Body weight. 2nd. Wt.	Wt. lost.
			Hrs.m.									
Mch. 7	Mr.C.	6	3.15	131·12	130·06	1·06	Mr.E.	4	3.15	135·37	135·25	·12
" "	" I.	"	" "	122·81	121·87	·94	" J.	"	" "	140·96	139·50	1·46
" "	-	-	-	-	-	-	Mr.C.	6	2.15	131·37	130·46	·91
" "	-	-	-	-	-	-	" I.	"	" "	123·00	122·03	·97
" 11	Mr.C.	6	3.15	131·37	131·09	·28	Mr.J.	4	3.15	141·59	139·43	2.16
" "	" I.	"	" "	124·31	123·15	1·16	" L.	"	" "	136·65	135·56	1·09
" "	" K.	"	" "	147·62	146·50	1·12	" M.	"	" "	141·81	141·15	·66
" "	" O.	"	" "	148·75	147·12	1·63	" N.	"	" "	132·56	122·12	·44
" "	" P.	"	" "	135·43	134·56	·87	-	-	-	-	-	-
" 12	Mr.J.	4	3.0	140·87	140.00	·87	Mr.C.	6	3.0	131·75	130·75	1.00
" "	" L.	"	" "	136·56	135·93	·63	" I.	"	" "	123·43	122·50	·93
" "	" M.	"	" "	144·68	143·56	1·12	" K.	"	" "	149.00	147·00	1·00
" "	" N.	"	" "	122·12	121·62	·50	" P.	"	" "	136·25	135·43	·82
" "	-	-	-	-	-	-	" Q.	"	" "	154·18	153·06	1·12
" 14	Mr.C.	6	3.0	130·18	129·40	·78	Mr.J.	4	3.0	139·62	139.00	·62
" "	" I.	"	" "	123·00	122·28	·72	" L.	"	" "	135·68	134·78	·90
" "	" K.	"	" "	147·62	146·68	·94	" M.	"	" "	144·06	143·18	·88
" "	" O.	"	" "	148·37	147·53	·84	" N.	"	" "	122·93	121·75	1·18
" "	" P.	"	" "	136.25	135·56	·69	-	-	-	-	-	-
" 15	Mr.E.	4	3.15	135·25	134·18	1·07	Mr.I.	6	3.15	123·37	122·56	·81
" "	" J.	"	" "	140·81	139·93	·88	" K.	"	" "	149·50	147·50	1·00
" "	" L.	"	" "	137·25	135·93	1·32	" O.	"	" "	148·93	148·18	·75
" "	" M.	"	" "	143·90	143·39	·53	" P.	"	" "	136·37	135·68	·69
" "	" N.	"	" "	122·65	121·37	1·28	-	-	-	-	-	-
" 18	Mr.I.	6	3.0	123·90	122·18	·82	Mr.J.	4	3.0	141.06	140·34	·72
" "	" K.	"	" "	147·81	146·56	1·25	" L.	"	" "	136·06	135·25	·81
Mch. 18	Mr.O.	6	3.0	149 18	148·31	·87	Mr.M.	4	3.0	145·87	144·62	1·25
" "	" P.	"	" "	136·81	136·75	1.06	" N.	"	" "	122·87	121·43	1·44
" 19	Mr.E.	4	3.0	134·43	133·31	1·12	Mr.C.	6	3.0	130·50	129·59	·91
" "	" J.	"	" "	140·96	139·25	1·71	" I.	"	" "	123·34	122·50	·84
" "	" L.	"	" "	136·62	135·56	1·06	" K.	"	" "	147·62	146·06	1·56
" "	" M.	"	" "	145·68	144·68	1.00	" O.	"	" "	148·81	148·00	·81
" "	" N.	"	" "	122·62	121·75	·87	" P.	"	" "	136·25	135·31	·94
" 20	Mr.C.	6	3.0	130·81	129·68	1·13	Mr.J.	4	3.0	139·12	138.50	·62
" "	" I.	"	" "	124.03	123·18	·85	" L.	"	" "	136·68	135·87	·81
" "	" K.	"	" "	147·37	146·43	·94	" M.	"	" "	145·87	145·18	·69
" "	" O.	"	" "	147.50	147.00	·50	" N.	"	" "	123.06	122.25	·81
" "	" P.	"	" "	135·43	134·68	·75	-	-	-	-	-	-
" 21	Mr.E.	4	3.0	135·18	132·87	2·31	Mr.C.	6	3.0	130·06	129·31	·75
" "	" J.	"	" "	140·18	139·31	·87	" I.	"	" "	122.25	121·50	·75
" "	" L.	"	" "	136·75	135·81	·74	" K.	"	" "	147·18	146·43	·75
" "	" M.	"	" "	145·68	145·25	1·43	" O.	"	" "	147·18	146·75	·73
" "	" N.	"	" "	123·18	122·06	1·12	" P.	"	" "	136·25	136.00	·25
" 22	Mr.C.	6	3.15	131·62	130·84	·78	Mr.E.	4	3.15	134·31	133·25	1·06
" "	" I.	"	" "	123·06	122·12	·94	" J.	"	" "	140·43	139·68	·75
" "	" K.	"	" "	146·81	146·00	·81	" L.	"	" "	136·68	135·81	·87
" "	" O.	"	" "	147·68	146·62	1.06	" M.	"	" "	146·18	145·00	1·18
" "	" P.	"	" "	136·12	135.06	1·06	" N.	"	" "	122·25	122·18	·07
" 25	Mr.E.	4	3.0	135·50	134·43	1·07	Mr.C.	6	3.0	132·43	131·31	1·12
" "	" J.	"	" "	140·62	139·71	·91	" I.	"	" "	123·56	121·75	1·81
" "	" L.	"	" "	134·62	133·75	·87	" K.	"	" "	147·56	146·25	1·31
" "	" M.	"	" "	146.87	145·50	1·37	" O.	"	" "	146·81	146·18	·59
" "	" N.	"	" "	122·25	121·37	·88	" P.	"	" "	137·31	136·37	·94
" 26	Mr.C.	6	3.0	131·93	130·93	1·00	Mr.J.	4	3.0	141·28	140·31	·97
" "	" I.	"	" "	122·68	121·87	·81	" L.	"	" "	135·62	134·75	·87
" "	" K.	"	" "	147·93	146·68	1·25	" M.	"	" "	145·81	144·93	·88
Mch.26	Mr.O.	6	3.0	148·00	147·25	·75	Mr.N.	4	3.0	123·37	122·43	·94
" "	" P.	"	" "	136·75	136·18	·57	-	-	-	-	-	-
" 27	Mr.E.	4	3.0	135·18	134·18	1·00	Mr.C.	6	3.0	131·50	130·68	·82
" "	" J.	"	" "	141·15	139·87	1·28	" I.	"	" "	122·37	121·56	·81
" "	" L.	"	" "	135·87	135·12	·76	" K.	"	" "	147·31	145·62	1·69
" "	" M.	"	" "	145·75	144·00	1·75	" O.	"	" "	147·62	146·56	1.06
" "	" N.	"	" "	122·25	121·06	1·19	" P.	"	" "	136·75	136.00	·75
" 28	Mr.C.	6	3.10	131·65	130·43	1·22	Mr.J.	4	3.10	140·31	139·25	1.06
" "	" I.	"	" "	122·37	121·56	·81	" L.	"	" "	136·81	136·75	.06
" "	" K.	"	" "	145·81	144·06	·75	" M.	"	" "	144·31	143·50	·81
" "	" O.	"	" "	144·81	143·62	1·19	" N.	"	" "	121·50	120·50	1.00
" "	" P.	"	" "	136·81	136·06	·75	-	-	-	-	-	-

Average loss per man per hour .3051bs.

Average loss per car per hour .202 lbs.

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RIVERS POLLUTION.

WITH SPECIAL REFERENCE TO THE BOARD PROPOSED BY THE ROYAL COMMISSION.

By SIR WILLIAM RAMSAY, K.C.B., F.R.S., LL.D., D.Sc.

Read at Sessional Meeting, London, February 12th, 1908.

THE subject of the pollution of our rivers has occupied the attention of the Government of the day since 1843. In 1843 a Public Health Act was passed; and in 1857 a Royal Commission was appointed to inquire as to the best mode of distributing the sewage of towns. The labours of the Commission lasted till 1865, when it issued its third official report. Its life was eight years. In 1868 a new Commission was appointed, which reported finally in 1874, after six years' life. In 1884, 1885, and 1886 the Metropolitan Sewage Commission was at work on the rivers Thames and Lea. In 1898, on May 7th, the present Commission was appointed; it has published four reports, and a fifth is on the stocks, and will soon be issued. Since the earlier Commission sat, bacterial methods of an artificial nature had been introduced, and the whole complexion of the purification of sewage was changed. This was largely due to Mr. Warington's researches on nitrification, and the development of Pasteur's ideas of the enormous influence of bacteria on health and disease.

The present Commission has thus existed for nearly ten years. Of the original members, only three remain: the Chairman, Lord Iddesleigh; Colonel Harding; and myself. Four members have been removed by death: Sir Richard Thorne, Dr. Russell, General Carey, and Sir Michael Foster; others have resigned. Our Secretary, Mr. Willis, is still admirable and efficient. The laboratory staff, though changing its junior

members, retains its senior members, Dr. McGowan, Dr. Houston, and Mr. Colin Frye; Professor Boyce, now Sir Rupert Boyce, withdrew some years ago.

During these ten years, the whole subject of sewage purification by land treatment and by artificial means has been very carefully studied, partly in special works lent for the purpose, partly by the staffs of large cities, with whom there has been constant and friendly relations; and partly in our own laboratories at Ealing, Dorking, Leeds, and London. I do not intend, on this occasion, to speak of any of the special methods of sewage disposal; descriptions of these are to be found in the reports already issued, and will be found in one shortly to be published. Besides, I have myself given a cursory sketch of our work in a paper read to the Congress of Chemistry at its meeting at Rome in 1906, a translation of which has been published in appropriate journals. I may refer, too, to a very useful digest of our work published in 1905 by Mr. Arthur J. Martin (Van Nostrand & Co.), which, in a masterly manner, gives a summary up to that date. I wish rather to insist on the fact that the whole question of sewage disposal has grown beyond the powers of a Royal Commission, that it is intimately connected with our water supply, and that the Government should create a permanent Board, for reasons which I will now proceed to explain. I shall also endeavour to sketch the functions of such a Board.

1. There can be no finality in investigations of the kind which we have undertaken. The more known, the more one realises what is to be known. To parody Newton, we have been gleaning a few algæ from the surface of sewage-tanks, not knowing the wealth of bacteria still uninvestigated which the tanks contain. It is true we have ascertained certain general truths, that sewage contains bacteria, sometimes harmless, sometimes harmful; that on exposure to air some of these develope and consume the organic matter, converting it into carbon dioxide, water, nitrites and nitrates; that if excluded from air, bacteria, probably of a different kind, certainly of different action, alter the organic matter, producing marsh-gas and carbon dioxide, and changing the nature of the complicated matter of the sewage. It is probable that the sewage-matter is largely attacked by creatures of higher function, worms and the like, before it is finally attacked by bacteria; but of this we know practically nothing. We have had to concern ourselves with results rather than with modes of operation. The life-history of all these creatures is almost an unexplored field.

Nothing can be more certain than that an advance in knowledge useful to man has been made by a careful study of agents, chemical, physical and

biological. To quote oft-quoted instances: it was Faraday who founded the industry of modern electric appliances, by his study of the magneto-electric machine; it was Perkin who founded the colour-industry, by his work on the oxidation-products of aniline. We have every reason to believe that persistent, continuous work on the chemical and biological aspects of the sewage problem would yield as far-reaching results. For this reason, if for no other, a permanent laboratory staff should be formed.

2. But there are many other reasons. There are at present certain Authorities which deal with certain rivers. The Mersey and Irwell, and the West Riding of Yorkshire Rivers Boards, the Conservancies of the Thames and the Clyde are instances in point. It is necessary that an Authority should have jurisdiction over the whole course of a river. Who is to say when pollution is first introduced? What is the use of a Local Authority, whose jurisdiction lies well down a stream, purifying its sewage to turn it into a river much more foul than the purified sewage effluent? We must have more Rivers Boards. An estimate would show that some fifteen must be created.

The functions of these Boards, however, should not cease when the rivers under their charge are fairly pure: they should have control of the local water supply. It is they who should know the risks of contamination, and should have means at their disposal to prevent it.

Such local Rivers Boards, however, must necessarily be composed of local men. Many of these must of necessity be manufacturers, who themselves produce trade effluents. The disposal of such effluents in the sewage-plants may or may not be feasible. And disputes have frequently arisen between Local Authorities and such members of Rivers Boards as regards the disposal of their refuse. In many cases the contention that, as such manufacturers pay a very large share of the rates, they should not be made to pay more for the disposal of their refuse, has a certain measure of justification. Should a dispute occur, the only remedy now is a Court of Law, with its slow procedure, its professional witnesses on both sides, and its heavy costs. In one case, the cost of such a dispute (a trivial one at first) was £8,000.

Again, it may happen that a new or an enlarged water supply is necessary. The water company suggests a supply; the Local Authority doubts its purity. The recent case at Great Yarmouth and Lowestoft is a case in point. The water company desired to increase its supply from the River Bure: the town considered that supply contaminated. After two years' parliamentary litigation, in which the question was debated

twice before a committee of the Lords, and twice before a committee of the Commons, the matter was compromised by the water company putting in a few settling tanks, of a few hundred pounds value. Two years had been wasted, and I suppose £10,000 spent; and after all, the water company would have been willing to meet the town at the very beginning.

Again, it may happen that the drains, though capable of disposing of domestic sewage, are not large enough to deal with trade effluents. The manufacturer has no facilities for purifying his effluent, besides any purification which he might effect would not be nearly so complete as if his effluent were to be treated by one of the bacterial methods, now common. What is to be done? Who is to pay for the extra sewers? If decided on by the local Rivers Board, the manufacturer may be inclined to charge them with partiality; or it may happen that the interest of those on the Board is to keep matters *in statu quo*, and the river runs on, unpurified.

Such are the problems which face Rivers Boards. Those which exist are on the whole very efficient, and have done much to improve their water courses; but such difficulties as I have mentioned do, and must necessarily arise.

3. For the reasons given (continuous investigations as regards pure effluent and pure water; control over Rivers Boards as to the standard of their work: and judicial functions, in settling disputes out of court) the Commission has recommended the creation of a Central Authority for the whole of the kingdom, with its office and laboratories in London.

Its functions would be:

1. To continue the investigation of all processes for disposing of sewage, and to report from time to time.
2. To pay visits (through inspectors) to the various local Rivers Boards, and help them with advice. Indeed, the most thoroughly friendly co-operation should exist between the Rivers Boards and the Central Authority.
3. To act as a court of appeal, so that in case of dispute between a Local Authority and a local Rivers Board, the decision of the Central Authority, after due investigation by its own experts, with evidence from both sides, should be final, and should carry with it the weight of a decision by a court of law.

4. I have omitted to put forward two of the most important duties

which would fall to the share of the central authority, both of which should be at once undertaken:

a. The Central Authority should inquire at once, and should advise the Government as to the particular Rivers Boards which must be created, so as to cover the whole country.

b. The Central Authority should prepare a plan whereby the water supply of the whole country and the local demands should be mapped out. This is so essential and important, that I will say a few words about it.

The population of our towns is ever increasing. The water supply, ample at present, will be too small in a few years, unless it is properly conserved.

Now, I will suppose that the East of England towns find that local wells and rivers are insufficient to supply them, and that they propose to derive a supply from Wales. This, it must be remembered, is an exaggerated and purely supposititious case, merely intended for purposes of illustration. They acquire the right to draw water from some Welsh lake. Suppose, for the sake of argument, that the town of Birmingham, say, does not oppose; then, in twenty years' time, when Birmingham has grown still larger, its water supply becomes inadequate. It is on the direct line of the East Anglian-Welsh pipes; but it cannot avail itself of them. It is much more likely that Birmingham would oppose, and that costly law-suits would be the result.

It is so obviously to the public advantage to have a complete survey of the water supplies available considered in relation to the needs of the various localities, that the case hardly admits of argument. An expert in such matters (rainfall, etc.) should form part of the staff of the Central Authority, whose business it should be to prepare such a survey, with the help of his colleagues, and with information supplied by the Rivers Boards.

One word in conclusion. Such a Central Authority would not involve the country in much expense: at a liberal estimate, £10,000 a year would suffice, at present, and (so far as can be foretold) for many years to come.

I may also remind you of the successful working of the Alkali Act, and of the enormous use which the inspectors have proved, both to the public and to manufacturers. These gentlemen are not supposed to offer official advice to manufacturers. But they pass on to one manufacturer the knowledge that to dispose of such or such a nuisance so and so may be consulted. The removal of the nuisance is often accompanied by a profit

to the manufacturer. I can conceive of the chemists and inspectors of the Rivers Boards fulfilling a similar function. Suppose A. wants a scheme for sewage disposal. The inspector, knowing the local circumstances, directs A.'s attention to B.'s plan, which will be least costly, and best suited to his requirements. In this manner much good would be done.

It is common knowledge that Mr. John Burns, the President of the Local Government Board, has given a very favourable reception to a deputation from the British Science Guild, who waited on him to urge the creation of a Central Authority. A Bill has been drafted, and it is hoped that it will become law this session. It is my object to ask you to do all in your power to influence public opinion in its favour.

The members of the Commission, alas! are not eternal: they have worked for ten years in the public service, and they would like to see their work carried on in such a manner as most to benefit our country.

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Excerpt from Third Report (1903) *of Royal Commission on Sewage Disposal.*

II.—THE NEED OF SETTING UP A CENTRAL AUTHORITY.

THE SETTLEMENT OF DIFFERENCES BETWEEN LOCAL AUTHORITIES AND MANUFACTURERS.

40. In an earlier section of this Report we have referred to the necessity of providing machinery for the settlement of differences between local authorities and manufacturers.

The chief questions upon which differences may arise are the following:—

1. The refusal of a local authority to allow a particular trade effluent to enter their sewers.
2. The refusal of a local authority to construct or enlarge sewers for the purpose of a particular manufactory.
3. The question of varying general regulations as to preliminary treatment by the manufacturer.
4. The amount of the special charge to be imposed on the manufacturer.
5. The removal of sludge.

41. We have taken a considerable amount of evidence as to the means which should be adopted for settling these differences.

* * * * * *

CENTRAL DEPARTMENT ESSENTIAL.

44. In our opinion a properly equipped Central Authority is essential, and we unhesitatingly recommend the creation of such an Authority.

In the interests of river purification as well as of the trade of the country we consider it is of the highest importance that the changes in the law which we have recommended should be made. But these changes would not in our opinion be of much use apart from the creation of a Central Authority for the determination of differences between the local authority and the manufacturer.

If the settlement of these differences be left to the ordinary Courts, differential treatment of manufacturers, with all the objections to it, will be certain to continue.

45. The Central Authority should have the following permanent chief officers:—

1. An Administrative Head.
2. A Bacteriologist having special knowledge of the bacteriology of sewage, trade effluents and water supply.
3. A Chemist having special knowledge of the chemistry of sewage, trade effluents and water supply.
4. An Engineer having a special knowledge of geology and water supply.

It should also be provided with a laboratory.

46. The officers of the Central Authority must be clothed with the necessary powers to conduct inquiries, to call witnesses, to enter premises to take samples of the trade effluent, and generally to do such acts as are necessary for the proper performance of their duties.

47. At any inquiries which may be held neither Counsel nor expert witnesses should be heard except with the special permission of the Central Authority.

48. The work of the Central Authority will be so intimately connected with the work of the Local Government Board that it will be desirable to make it a new department under the Local Government Board rather than an entirely separate department.

49. Certain witnesses expressed the fear that the decisions might be less speedy if the Authority were placed under the Local Government Board than they would be if an entirely separate department were constituted. This objection, however, does not seem to us to be valid. We can scarcely assume that the work will be regarded as less important, and therefore that the staff will be less adequate, merely because the Authority is attached to the Local Government Board.

50. We share the desire that differences which are referred to the Central Authority should be speedily dealt with, but it may be well to point out that some of the questions which will have to be determined cannot properly be decided without careful investigation, that at present a decision in the Law Courts is only arrived at after long and expensive proceedings, and that, although we think that much of the existing delay and expense will be avoided by the adoption of our recommendations, it will not be possible in all cases to arrive at speedy decisions.

It will be obvious, too, that at the commencement of the operation of the new scheme delays must needs arise which will subsequently be avoided.

* * * * * *

61. The Central Authority, which we have recommended should be set up for the determination of differences between the local authorities and the manufacturers, should deal also with this matter. For this purpose it will be desirable to add an Epidemiologist to the staff of the Central Authority.

We do not, however, consider that the Central Authority should take the place of local bodies in regard to the protection of rivers and other sources of water supply. On the contrary, we think local power should be utilised to the fullest extent possible.

FORMATION OF RIVERS BOARDS THROUGHOUT THE COUNTRY.

62. In our opinion such power can only be fully utilised by the formation of Rivers Boards throughout the country, and we therefore recommend that such Boards should be formed.

63. Although the Rivers Boards are merely joint Committees of County* Councils, and therefore only possess for the combined areas the same powers which the individual Councils might have exercised in their respective districts, we are satisfied that such combinations are of much greater value for the protection of rivers and streams than the separate Councils acting independently.

64. In the first place, they are bodies expressly created for enforcing the provisions of the Rivers Pollution Prevention Act, whereas the separate County Council is under no obligation to enforce these provisions. And we find as a fact that in many counties outside the areas represented by the existing Rivers Boards little or nothing is done by the County Council to exercise its powers of checking river pollution.

65. Then, too, a Rivers Board has jurisdiction over practically the whole of a watershed. This is a point of considerable importance.

It has been again and again pointed out by previous Commissions that to obtain effective action there should be some one authority with power to deal in each instance with the whole watershed, and we entirely concur in this view.

66. Another advantage of combination is that the area under the jurisdiction of a Rivers Board is sufficiently large to secure the appointment of skilled officers.

67. We have not sufficient information to enable us to say what precise combinations should be made. Each Rivers Board district should however include, as far as practicable, the whole of one or more watersheds, and it should

* Under the Local Government Act, 1888, the Council of a County Borough is for this purpose a County Council.

be sufficiently large to justify the permanent appointment of a skilled Chief Inspector at an adequate salary.

One of the first duties of the Central Authority will be to ascertain what grouping of counties would be most effective, and then to take steps to constitute Rivers Boards for these areas.

DUTIES OF RIVERS BOARDS.

68. We have found in the course of our inquiry that water supplies are liable to other serious pollutions besides those which can be dealt with under the Rivers Pollution Prevention Act, and although in the case of the larger water undertakings the owners may be desirous of doing all that is possible to safeguard their sources of supply, we are satisfied that there are cases where the supervision of some superior authority is desirable in the interests of public health.

Such supervision could, we think, be usefully carried out by the Rivers Boards, and we therefore recommend that, in addition to the duties which these bodies will possess under the existing law in regard to pollution of rivers and streams, it should also be their duty to inspect public water supplies and to report to the Central Authority any cases of dangerous pollution of such supplies which they may detect.

69. The Chief Inspector of each Rivers Board should be required to make an annual report on the work of each year, and copies of these Reports should be supplied to the Central Authority.

FUNCTIONS OF CENTRAL AUTHORITY.

70. The Central Authority should exercise a general superintendence over the whole country in regard to the prevention of pollution of water. They should direct any inquiries or investigations which they may consider desirable, and generally they should stimulate and encourage Rivers Boards to an active exercise of their powers.

71. As regards dangerous pollutions of public water supplies it should be the duty of the Central Authority to investigate cases brought to their notice by the Rivers Boards, and in any case in which they are satisfied that the conditions are such as to render the supply dangerous to health they should bring the facts to the notice of the Company or Local Authority which is supplying the water.

72. We should hope that this would usually suffice, and that the supplying authority would willingly take such steps as might be necessary to remove the danger.

But it is perhaps necessary to provide for other cases, and we therefore recommend that the Central Authority should be empowered, after local inquiry to order the purveyors of the water, or other responsible parties, to adopt such means as in the opinion of the Central Authority are reasonable and necessary for removing or diminishing the danger.

Such orders should be enforceable by mandamus.

73. Power to enter at all times gathering grounds and waterworks and to take samples of water should be conferred on the officers of the Rivers Boards and of the Central Authority.

WASTE OF WATER AND ABSTRACTION OF WATER FROM ONE DISTRICT FOR DISTRIBUTION IN ANOTHER.

74. In regard to the further questions which are referred to by the President of the Local Government Board it appears to us that the Central Authority might, with the aid of the Rivers Boards, very properly collect such information as is available throughout the country in regard to waste of water by pumping from mines, and in regard to the abstraction of water from one district, for the supply of another district, to the detriment of the water supply of the district from which the water is taken.

75. We entirely agree that the collection of such information should precede the consideration of the question whether legislative interference in regard to these matters is desirable.

Dr. S. Barwise (Derbyshire C. C.) said that he was in agreement with Sir William Ramsay as to the advisability of forming a central authority to deal with the question of river pollution, but he saw no necessity for the establishment of a new department. The Local Government Board was the department which should be the central authority. Everyone who had had experience of that Board must have been struck with the way in which the personnel of the Board had been strengthened during the last twenty years. He thought that it would be a pity that the experience which had been obtained by the staff of the Royal Commission on Sewage Disposal should be wasted on the nation, and this might be avoided by taking over the experts of the Commission as permanent officials of the Local Government Board.

To set up an independent authority to deal with such diverse subjects as the purification of sewage and the conservation of water supplies was a fantastic and chimerical idea. They must remember that areas for the supply of water were not coterminus with river basins. As an example, why should the people in a few Welsh counties be rated to pay for the services of a staff for maintaining the purity of the water consumed by the people of Birmingham. There was no necessity for any such scheme. The Derwent Valley Water Act passed by Parliament in 1899 shewed this. Under that Act the water of a large gathering ground was appropriated for the use of the people of Derbyshire, Sheffield, Derby, Leicester and Nottingham, and that Act must be regarded as the type of future water Acts.

If a central authority was set up he did not see that it was going to diminish the expense of litigation, or the expense that the authorities would be put to in obtaining the services of the highest experts.

Further, the question of water supply had never been referred by Parliament to the Royal Commission, and if, instead of dealing with matters which had never been referred to them, they had concentrated themselves upon work which Parliament had set them to do, their final report might have been out before this. Although he was against a separate central authority being set up, he quite agreed that the Local Government Board if strengthened might (as he suggested in his evidence before the Royal Commission) publish each year an epitome of the latest researches in sewage purification, and thereby be of the greatest service to the local authorities in the country. That was as far as he thought it was necessary to go.

With regard to the universal establishment of rivers boards, where the county councils had not enforced the Rivers Pollution Prevention Act rivers boards were necessary, but in those counties such as the one he represented, Staffordshire and other midland counties, the county councils had already provided the machinery for enforcing the Rivers Pollution Prevention Acts, and it would be very unfair to take those powers away from them. With regard to a river passing along the boundary of a county, this did not constitute any difficulty: as a case in point he might refer to the River Erewash passing along the boundary between Derbyshire and Nottinghamshire. The Derbyshire County Council had had a meeting with the Nottinghamshire County Council, and the two councils had agreed to serve Orders of Court on all authorities that were polluting, so that they would all complete the scheme by the same date. This was a very simple procedure and shewed that there was really no difficulty such as had been suggested.

In Derbyshire the county council had appointed him 17 years ago to administer the Rivers Pollution Prevention Act. They had subsequently appointed a river inspector and two chemists to devote their whole services to the county council under this and other Acts. They had published a quarterly return of effluents, and nearly a million of money had been spent in the county in purifying the rivers. He believed that if the Royal Commission would only publish their final report, it would so strengthen the hands of the county council that in ten years all the existing pollutions would be dealt with.

If a Bill is to be introduced for the formation of Joint Rivers Boards, it at any rate should contain a clause that those rivers boards should only include within their scope the areas of county councils who had failed to carry out their statutory obligations under the Rivers Pollution Prevention Acts.

Dr. Gilbert J. Fowler (Manchester) agreed with Sir William Ramsay that there was no finality in research work on the subject of sewage purification. It might be objected that the principles of sewage purification had been established long since. But while the art of producing wine may have been known to Noah and the methods of brewing to the ancient Egyptians, it had needed the researches of Pasteur, of Hansen, of O'Sullivan, and many others to render

possible the economic conduct of the great fermentation industries of to-day. The problem of the economic purification of sewage was, he ventured to think, a much more complex one than these. Instead of a liquid of fairly constant composition we had to deal with one varying from day to day and from hour to hour. Instead of a few well-defined fermentations with well-known organisms, we had all sorts of complex changes brought about by organisms varying from the simplest micrococcus through various forms of algæ and infusoria up to worms and leeches, and even (as in the recent work in Berlin) fish.

Under these circumstances he considered that the Royal Commission had exercised a wise reserve in holding their hands, and finally in bringing forward the proposals which they were discussing this evening.

It was the general custom in this country to proceed by the method of trial and error. It was a method capable of leading to ultimate success, but often at great cost. Our Continental colleagues endeavoured to approach such problems as this from first principles, and occasionally, perhaps, overlooked important practical considerations. The establishment of a central authority would, he thought, combine the advantages of both methods.

It would be of great use if such an authority would from time to time publish authoritative reports as to the conduct of various works. At the present time there were frequent accounts in the technical press of the starting of new works, but we seldom heard very much more about them.

It had been stated in high quarters, he believed, that such an authority would tend to impair individual initiative. He did not think that would be so. Speaking for himself he was glad to take that opportunity of expressing his indebtedness to the members and officials of the Royal Commission for their encouragement and kindly criticism, and he was sure there were many workers up and down the country who could say the same.

Mr. James Watson (Bradford) said that forty years ago the proposal to create a Central Board not unsimilar to that now proposed was a recommendation of one of the many Commissions on Water Supply and Rivers Pollution, which recommendation no one had ever since seriously attempted to get put into practice.

The subjects of Rivers Pollution and Water Supply were too extensive and important to entrust to such a Central Board as that now proposed, namely, three professional men and an administrator, and the powers proposed to be given to those gentlemen were so far-reaching that, before being sanctioned, they seemed (to him) to demand much greater consideration than had yet been given to them.

The function of a Central Authority for the whole of the kingdom, with its offices and laboratories in London, would be:

1. To continue the investigation of all processes for disposing of sewage, and to report from time to time;

2. To pay visits (through inspectors) to the various local Rivers Boards, and

help them with advice, so that thoroughly friendly co-operation should exist between the Rivers Boards and the Central Authority;

3. To act as a court of appeal, so that in case of dispute between a local authority and a local rivers board the decision of the Central Authority, after due investigation by its own experts, with evidence from both sides, should be final, and should carry with it the weight of a decision by a court of law.

4. Two of the most important duties which would fall to the share of the Central Authority, both of which should be at once undertaken, would be: *a*. To inquire at once, and advise the Government, as to the particular Rivers Boards which must be created, so as to cover the whole country: *b*. To prepare a plan whereby the water supply of the whole country and the local demands should be mapped out. This is essential and important, and if sanctioned, with 15 Rivers Boards, £10,000 per annum would meet the cost.

To vest such a Central Board with the powers asked would be a somewhat hazardous experiment, and one that (in his opinion) would not be to the best interests of the three kingdoms.

To leave the fixing of standards of purity to such a Board, whose methods of procedure, as set out in the paper, would be in many instances at variance with the provisions of numerous statutes now in force, as well as the common law of the land (a board whose decision formed, with or without outside skilled advice, legal and otherwise, as may seem to these three gentlemen necessary and sufficient), is setting up a tribunal to deal with great complex problems, which some evidently think simply and easily dealt with. To clothe such an authority with powers to conduct inquiries, to call, or refrain from calling, expert witnesses or counsel unless by their special permission, would be placing powers in the hands of three men sitting as judges who, *per se*, could not possibly have intimate personal knowledge and experience of the rivers or water supplies of the three kingdoms, such as would command the confidence and respect of the authorities, and where the aspects *qui* circumstances, location, and methods (different in almost every case over the length and breadth of the land) had to be decided on.

Who would pay for this Government administration? The Government, or those who had to carry out the behests of this Government Board?

A geologist and waterworks engineer with an expert knowledge of the geology, hydrology, rainfall, areas, watersheds, works, and wants of the three kingdoms could not be got in one and the same man, and should such a phenomenon be set up, even under the patronage of Government, it would soon be felt that, as in times past and as now, such work was sufficient in each department and their many branches to take up the constant time and consideration of many men. Why, some of our present-day men from their eminent and expert knowledge of their own particular branch of scientific engineering, could not be secured by the Government for more money per annum than this central authority, with its 15 additional staffs scattered over the country, is estimated to cost.

Mr. J. D. Watson (Birmingham, Tame, and Rea District Drainage Board) considered that the time had come when it was necessary to bring methods and works more into line than they were at present: not that the conducting of experimental works all over the country was harmful, but in his view these experiments were not comparable, they were misleading in many cases, and they were unnecessarily costly. If experimental work were undertaken by a central authority such weaknesses would be overcome to a very large extent. Large boards would probably continue to make their own experiments, but it would probably be found by all engineers to be advantageous to put themselves in touch with the experts of the central authority in order to obtain the fullest information and the most unbiassed opinion available. In his opinion it would be of the greatest possible advantage to have such an authority to consult and to appeal to in time of difficulty. He could not imagine that the work of such an authority would encroach upon the province of the engineer unless, perhaps, in his capacity of expert witness, and no engineer worthy of the profession would hesitate to condemn prolonged and wasteful litigation.

As he understood the functions of the proposed central authority, they would materially help forward the work of sewage purification and prevention of rivers pollution. The authority would be an adjunct of the Local Government Board not opposed to it but distinct from it, and by its composition would command a respect in all matters pertaining to sewage disposal which the Local Government Board, for want of the necessary expert advice, did not lay claim to.

Some people spoke as if they were afraid to commit such power to a new Government Department. He had no sympathy with that view. Nobody complained of the Local Government Board having too much power, or of their decisions being irrevocable only by Parliament; but complaints were made that that body was too unsympathetic with new ideas, too unscientific, and altogether too unadaptable to new and progressive methods. These were the very failings which it was sought to correct by the establishment of this Board.

There were many matters connected with sewage disposal which required further elucidation. Those who had constructed large sewage purification works probably had exceptional advantages for carrying out experiments, but engineers and chemists generally were much handicapped by the costly nature of experiments of size sufficient for reliability; the staff of the central board would have many opportunities for experiment, and their experiments would always be available to local authorities and their advisers in the construction of new works.

There were still many questions upon which experts are disagreed; for instance, standards. He maintained that an effluent which had an oxygen absorbed figure of 9 parts per 100,000 might be fit to enter a river, and another which had the low figure of ·9 parts per 100,000 might be unfit. Again, it was unwise to impose as stringent conditions on a town like Hull, which was situated on a

river three miles broad, as were imposed on a town like Birmingham, which had a river only a few yards broad and discharged an effluent the volume of which was greater than the volume of the river itself.

He took it that the central authority recommended by the Royal Commission would step in and say what had to be done by towns and districts as variously situated as Bristol, Birmingham, and York. They were bound by cast-iron methods at present, and he thought it desirable to have an authority who had the absolute power to say what should be done and what would be acceptable in each case. At present, an engineer called in to advise a local authority on the construction of new works laboured under a great difficulty. Generally he advised that works capable of treating at one time six times the dry weather flow of sewage were sufficient, but would such works comply with the law? He doubted it, and quoted from the abridged reports of arbitrations and law cases issued by the Incorporated Association of Municipal and County Engineers a recent judgment of the Chancery Division of the High Court, to show that neither six nor sixty times the dry weather flow had anything to do with the question.

The judgment stated that the test as to whether there had been an infringement of the 17th section of the Public Health Act, 1875, was "whether the local authority have conveyed into the stream at any point sewage or filthy water so as to deteriorate the purity and quality of the water at that point." If deterioration were proved by the discharge at any one point, it was no answer to say that, taken as a whole, "the operations have not produced any deterioration upon the stream as a whole."

The Local Government Board, by saying that three times the dry weather flow of sewage should be efficiently purified, and an additional three times partially, implied that anything above that quantity may be discharged without treatment of any kind; but they guarded themselves by saying that their conditions refer only to what must be done to earn their sanction to borrow money to execute the proposed works.

At Birmingham they had measured as much as 150 times the dry weather flow issuing from a large sewer in time of a thunderstorm; this at the best was rainwater after it had washed streets, back-yards, and flushed out drains, and could not possibly be discharged into a pasture and arable land-stream without deteriorating its quality.

The central authority would be empowered to say definitely how much or how little should be done, and thus relieve the engineer advising the local authority from the responsibility of designing works which are unnecessarily large or unsatisfactorily small.

MR. CHARLES HAWKSLEY (Westminster), past President of the Institution of Civil Engineers, said that while admitting that the scheme which had been suggested by Sir William Ramsay looked well on paper, he thought that in practice

it would fail to serve the end for which it was designed. All of them, at least those who had to deal with water supply and sewage treatment, knew how reference to a government department, instead of assisting in these matters had sometimes a contrary effect. Rules were laid down which were rigidly applied in season and out of season; and he thought the effect of a central authority such as that proposed would be rather to hinder progress than to assist it. Certain rigid rules would have to be adhered to, and those who desired to introduce new methods would not be received with much favour. The officials of a government department, after all, had their own interests to look to as well as the interests of others, and it was not to be expected of them that they should perhaps risk their reputation by allowing anything to be done which had not already been proved to be a success. Again, in the matter of waterworks, it was proposed that the central authority should keep the rivers pure. But at whose expense was that to be done? Was the expense to be borne by the people who were going to make use of the water, or by the landowners within the drainage area, or by the county, or by the state; all these were matters which would need most careful consideration. With regard to allocating the watersheds to various towns, he did not quite see how that was to be carried out. The proposed mapping out, which certainly appeared very good in theory, would in actual practice result in many admirable watersheds being kept for a use that would never come, because the central authority could not foresee the requirements of the future any better than other people. This central authority, he added in conclusion, would probably ultimately demand that Parliament should delegate to them their entire functions in regard to these matters, a course which would be a very unfortunate thing for the country. For the foregoing reasons, amongst others, he could not favour the creation of the proposed central authority.

Mr. Frank Scudder (Manchester) said he was the chemical adviser to the Mersey and Irwell Joint Committee, an authority that was constituted in 1891 with special powers for enforcing the prevention of river pollution in the Mersey and Irwell watershed. His chairman, unfortunately, owing to indisposition, was unable to be present at the meeting, but the speaker had obtained in writing the following expression of opinion regarding the reason why the Joint Committee did not agree with some of the recommendations of the Royal Commission.

They were of the opinion that if a central authority were to be created, it should be independent of, and not under the control of the Local Government Board, as such an authority would be in an important position, and therefore it would not be advisable for it to be only a minor department of another Government office.

The Mersey and Irwell Joint Committee considered that the powers given to the central authority, should not take away, or modify, any of the existing powers already enjoyed by the Joint Committee. The Mersey and Irwell Joint

Committee had, owing to the extensive powers given to them by their special Act of Parliament, been very successful in preventing the pollution of the Mersey and Irwell rivers and the tributaries connected therewith, and in view of the important work which they have so successfully carried on in the past, they considered it inadvisable to have any of the authority that they already possessed by Act of Parliament taken away, or the action or work of the Joint Committee subordinated to a central authority, as that would considerably hamper their usefulness.

The Joint Committee should not be called upon to act as arbitrators in any disputes between the sanitary authorities and the manufacturers; that was a position that the Committee had always avoided taking up, as they had considered that their duty consisted in preventing the pollution of the rivers in the watershed under their control, and the carrying out of such alterations and improvements as would minimise and eventually do away with all possible pollution, and they had always left disputes between the local authorities and the manufacturers to the proper legal authorities as to the settlement of the responsible party.

Sir William Ramsay had asked them to do all in their power to influence public opinion in favour of a Bill that had been drafted; but until the provisions of that Bill were made known, the Rivers Board desired the further consideration of the question to be left open.

Mr. W. Matthews (Southampton) observed that Sir William Ramsay asked them to do all in their power to influence public opinion in favour of a Bill, the provisions of which were as yet unknown to them, but which, under the circumstances, they could only assume was drafted upon the lines of the recommendations of the Royal Commission on Sewage Disposal as set before them.

Turning to the reference to that Commission it would be seen that it in no way specifically mentioned water supply, but was confined to river pollution, and especially to the question of pollution by sewage and trade effluents.

He believed he was correct in saying that the Commission had taken no evidence particularly directed to questions of water supply outside the definite reference referred to, either before or after the issue of the third report of 1903, and that the sweeping proposals to include, within the jurisdiction of the suggested river boards and central authority, the control of water supplies generally, only came about as a result of a deputation which waited upon Mr. Long, the President then in office of the Local Government Board at the end of 1902, and when the third report of the Royal Commission was practically ready to be issued.

That deputation was a strong and representative one, including delegates from the County Councils Association, The Royal Sanitary Institute, the Association of Waterworks Engineers, and some others; it urged that certain changes in the

laws regulating water supply were needed, and that some measure of competent and independent control over water supply was desirable, and asked Mr. Long to agree that a thorough and exhaustive inquiry into the subject was desirable. Mr. Long, while agreeing with the great importance of the question, was unable to promise such inquiry until he was satisfied that the subject was not already within the scope of the Royal Commission then sitting, and all they knew, from the appendix to the third report, was that he then referred the matter to the Commission, and that within the next three months, without any additional evidence being taken, the question of water supply was sandwiched into the report, and it was proposed to be dealt with by the creation of authorities having such powers as, one ventures to think, should not be suggested except after hearing the opinions of those eminently qualified to lead such a Commission to right conclusions.

The pollution of rivers and watersheds by sewage touched but one branch of the subject, and, unless the Commission went far outside its reference, much that would come within the jurisdiction proposed to be set up, could never have been considered at all, or at most as merely incidental. It seemed fair to inquire whether any direct evidence had been taken as to, among many other things, underground supplies, the abstraction of water from outside districts, and waste? If that was not so, the whole question obviously required much greater consideration before they were invited to assent, or ask for public support, to the creation of such supervision as that suggested.

The constitution of the Central Authority was open to criticism on the grounds put forward by Mr. Watson that geological and engineering knowledge of the necessary high standard were not to be expected in one individual; this principle had really been admitted in the recommendation to appoint a chemist as well as a bacteriologist, and the weakness of the recommendation was the more revealed when it was observed that, although sewage disposal must have been one of, if not the chief, point to which the attention of the Commission was given, it was not suggested that an engineer having a special knowledge of sewage works and sewage disposal should have any place in the Central Authority.

As to the cost, it would no doubt be agreed that £10,000 a year would be totally insufficient to properly carry out the work proposed. Sir William Ramsay suggested the necessity of having a rainfall expert, and the employment of inspectors to visit and assist the Rivers Boards, of whom 15 were to be created, the whole country was to be mapped out, and a mass of statistical matter collected, examined, and (one must assume) published. Unless the heads of the department were eminently qualified for their respective posts, and could consequently command sufficiently high remuneration, the control exercised would either be inefficient or lead to gross injustice and interminable disputes.

If supervision was to be tolerated it would have to be beyond suspicion as to its technical quality and superiority, and that this could not be ensured at anything like the cost suggested would certainly be endorsed by most professional

men who had any experience in those matters. Before such a scheme had a chance of receiving support it would have to be satisfactorily proved, that the control suggested was reasonable, to be exercised by persons eminently qualified for the duty, and that its efficiency was to be ensured and maintained by a proper and sufficient expenditure for the purpose; the enormous interests and capital (municipal and private) affected were too great to be lightly dealt with or jeopardised by any cheese-paring policy, quite apart from the question of public health, which, of itself, demanded that more consideration should be given to the special subject of water supply before any great step was taken in the direction indicated.

MR. HUGH P. RAIKES (Birmingham and Westminster) said that although the long life of the Royal Commission was not perhaps a matter of general congratulation, no one could more fully appreciate the magnitude of its work than those who had given evidence before it regarding the very complicated problem of sewage disposal.

The development of bacteria for the purpose of accelerating the disposal of sewage represented one of the most practical examples of applying the great sources of power in nature to the use and convenience of man, which had been claimed as the special prerogative of engineers as defined by the charter of their Institution.

It was, however, becoming more and more fully recognised that the solution of this problem could never be accomplished without the cordial co-operation of engineers and chemists as well as bacteriologists, for the disposal of sewage afforded ample scope for the ingenuity and researches of them all in their respective spheres, and although we were beginning to get a less confused view of the subject, those who had studied it most would be the first to admit that their knowledge regarding it was still exceedingly incomplete.

Although we knew how sewage can be effectually purified by certain alternative methods of treatment, no one is entitled to say that the problem of its disposal had been satisfactorily solved, until we know what is the most efficient and economical means of preventing river pollution under all circumstances.

It would be generally agreed, however, that there were no two places in which the local conditions were exactly alike, and this variation was really a most important factor in determining the best method of treatment to adopt, so that it was an exceedingly dangerous thing to generalize on the subject, or to recommend a certain system or arrangement of works, simply because it had proved successful at some other place, where there might be some difference in the local conditions, which might be far more important than might at first be apparent to anyone who had not made a special study of the subject.

Sir William Ramsay had therefore very properly pointed out that it would not be desirable for any Rivers Board to undertake the responsibility of advising

manufacturers or local authorities, and he ventured to think that their attention should be chiefly, if not entirely, directed to *Gaugings and Standards*, together with the appointment of experienced arbitrators to settle disputes relating to all questions connected with "River Conservancy."

The collection of reliable data regarding the flow of rivers and streams, together with the measurement of rainfall and the study of underground water supplies, was clearly a matter which might well be dealt with by a Government department, such as the Geological Survey in the United States of America, and if that work could be undertaken by Rivers Boards having the control of entire watersheds, they would also be well qualified to determine the standard of purity which might be reasonably required for sewage effluents or trade waste, and to see that the powers already possessed by the County Councils were properly exercised.

There did not seem to be any necessity, however, for establishing a large number of such Boards, or to materially interfere with the existing system of county administration, and he suggested that if six Rivers Boards were formed for England and Wales that would be sufficient, and there would be no great difficulty in so arranging these six districts, that each should include a certain group of counties, while at the same time embracing the whole watershed of all rivers passing through those counties.

Where it was found that the watershed boundary would not correspond with an existing county boundary, he suggested that the latter might in many cases be altered with advantage in the interest both of the County and of Rivers Board administration; but he was satisfied that comparatively few such alterations would, in fact, be found necessary if the Rivers Boards were limited to the number which he suggested as being sufficient for all practical purposes, and likely to be more efficient than a larger number of smaller authorities, which would be more liable to undue local influence.

Major Dent (Wakefield) stated that he was chairman of the West Riding Rivers Board. His Board were in favour of the constitution of a central authority. In his opinion it would be most useful in saying how much an authority should do with regard to purification of its sewage and in advising authorities (especially small ones) with regard to proposed schemes.

Prof. H. R. Kenwood (Stoke Newington) congratulated Dr. Barwise upon his optimism. Although, doubtless, a very great deal had been achieved under the able advice of Dr. Barwise in Derbyshire, he did not think it likely that in the course of our lifetimes the rivers of the country generally would be brought to anything approaching a state of perfection. At the same time he regarded Dr. Barwise's testimony of what had been done in Derbyshire, under a County Council which had acted as a Rivers Board would act, as the best of all arguments for requiring that all over the country the watershed areas should be mapped

out and dealt with on similar lines. The subject of Rivers Boards with jurisdiction over areas coterminous with the watershed areas of the country, was one which had often been discussed by the Institute, and as recently as October last the Council passed a resolution in favour of them. He could wish that the Boards when appointed could have an amended Rivers Pollution Prevention Act to administer, for there could be little doubt that the existing Acts were very unsatisfactory. The central supervising authority should, in his opinion, be a branch of the Local Government Board; with powers to enforce (where necessary) the requisite measures to protect the water supplies from contamination, to arbitrate in the case of dispute and to give final decisions. The central authority would be a very valuable addition to the public health provisions of this country. Many of the objections had been raised by those who spoke with great experience and knowledge, and they could not fail therefore to impress themselves upon the meeting. But he would venture to suggest that many of them were after all matters of detail which could be adjusted and provided for; and they did not necessarily make the scheme (the principles upon which they must all be agreed) either impossible or undesirable. More particularly did he welcome the suggestion that the central authority should be provided with a permanent laboratory staff, for in his opinion the research work on sewage purification was too fragmentary and interrupted, and often too exclusively local to be of the greatest value. If such a staff could go round the country and make their investigations at the various installations at present existing, comparing results with all the existing circumstances as they went along, many important facts which are awaiting an easy solution would be focussed and brought out; and probably we should learn more with reference to the kinds of treatment best adapted to different classes of sewage in 5 years than we should learn under the present unco-ordinated state of things in 50 years.

Mr. G. Montagu Harris (Secretary to the County Councils Association) said he should like to draw attention to the tactical situation. In 1902 a deputation of the County Councils Association, The Royal Sanitary Institute, and other bodies, interviewed the President of the Local Government Board, and asked that an inquiry by Royal Commission or otherwise might be undertaken as to the three questions of pollution, waste, and the depleting of one area for the benefit of another. It was thought that before such an inquiry was held the matter was not really ripe for legislation. Mr. Long referred those points to the Royal Commission, but as the commission had only a month or two out of its eight years in which to consider them, it could hardly be said that they were properly gone into. However, as Sir William Ramsay had stated that Mr. Burns had promised to introduce a Bill the matter was on a different footing. But in view of the enormous amount of proposed legislation it would appear very doubtful whether that Bill, even if introduced, would become law. As regarded one of the points, however (namely, that of pollution) the County Councils

Association drafted a Bill as long ago as 1896, which was introduced year after year by Sir Francis Powell with the usual ill success of private measures, and which, while it did not propose the establishment of a central authority, would deal with several of the other points mentioned by Sir William Ramsay. The Parliamentary Committee of the Association would consider the next day whether the Bill should be again introduced, and it would probably greatly assist the objects on which the meeting appeared to be agreed, if that Bill were supported, whether the Government Bill was introduced or not. It seemed surprising that Dr. Barwise should object to the idea of a Rivers Board having anything to do with the source of supply within its area. But that was the point which the County Councils Association felt was extremely important; and if Rivers Boards were to be generally appointed it was surely most desirable that all the questions relating to the purity and sufficiency of water supplies should be dealt with together.

Mr. Herbert T. Scoble (Westminster) said that it seemed to him that many of the difficulties referred to in the discussion respecting the safeguarding of water supplies were due to a misconception. He held that it was, and would remain, the duty of the supplying authorities and companies to see that their water was pure; no one could guarantee the water at the intake to be free from contamination. The chief objection that had been raised could be met by making the water-users (outside the area under the control of a Rivers Board) contributors to the funds, coupled with representation.

The question of sewage disposal was, perhaps, the one that was most in his mind in connection with Rivers Boards and the Central Authority. The general position was that, notwithstanding the Rivers Pollution Prevention Act of 1876, there was no official body to enforce compliance with the law. Nor, when a scheme of sewage disposal was sanctioned by the Local Government Board, was there any power to ensure that it would be properly carried out, or that after completion it would be kept in such condition as to give the best possible results. It was manifestly absurd that large sums of money should be spent and that there should be no control over the subsequent operation of the works. The existing Rivers Boards and, incidentally, some County Councils did insist on, and could press for, the provision of purification plant, and by means of visits from their inspectors were able to check the management of existing works. In the case of the three Northern Boards the work of supervision was accomplished at an average expenditure of one-ninth of a penny in the pound on the rateable value.

The fishing interests in many of our rivers were of great value, and much help towards the betterment of the water and information respecting pollution could, doubtless, be obtained by including representatives therefrom on the Boards. Amongst other matters requiring attention are the prevention of floods and the stoppage of the sludging of mill-dams.

DISCUSSION ON
PRESENT-DAY ROAD REQUIREMENTS IN TOWN AND COUNTRY.

Opened by ARTHUR BROWN, M.Inst.C.E.,
City Engineer, Nottingham.
(FELLOW.)

And E. PURNELL HOOLEY, M.Inst.C.E.,
County Surveyor, Notts.
(MEMBER.)

At Sessional Meeting, Nottingham, February 15th, 1908.

ARTHUR BROWN, M.Inst.C.E.

THE Road Requirements in Town and Country may, I think, be classed under six different heads :—

1. The surface must give good foothold for horses.
2. It must be as noiseless as possible.
3. It must be free from dust in summer, and free from mud in winter.
4. It must be of such a surface as will prevent side-slip with either motor cars or cycles.
5. The surface must stand the traffic of the district.
6. Lastly, the road must be cheap as regards first cost, or maintenance, or both.

The order of importance of those requirements is somewhat difficult to give. For instance, the man who drives a horse thinks good foothold is of the greatest importance, and many people who do not drive horses will agree with him. Residents who live abutting on our main highways consider absence of noise, and freedom from dust and mud, as being of the greatest importance. Cyclists and motorists take no interest in a road being noiseless, as they ride on rubber tyres, but they do demand roads

free from dust and mud, and consider a surface which does not encourage side-slip as a *sine quâ non*.

No. 5, that the road must stand the traffic of the district without undue expenditure in repairs, is one which the road engineer makes it his business to try and carry out. The last requirement, No. 6, is one on which we can obtain a unanimous vote: the road must be cheap.

I believe you will agree with me that the problem of making and maintaining the main streets and roads in our cities and counties is not an easy one, and it is rendered every day more difficult in consequence of the disinclination of the powers that be to spend more money on this object; money can be found, and has to be found.

I propose:

1. To shortly describe the various kinds of paving to be found in the main streets of our cities and urban districts, with the cost of each and how far each type fulfils any of the six requirements.
2. To refer to the dust nuisance generally, and describe some of the palliatives used to combat that nuisance.
3. To suggest what is to be the construction of the urban and country highway in the future.
4. What the improvement of roads will cost, and how will the money be found to pay for these improvements.

1. As regards the various kinds of road paving, &c., for main street and urban roads we have (*a*) granite sett paving, which is a favourite type with every road engineer on account of its durability. The kind of granite depends on the position, geographically, of the town; Nottingham, in consequence of its inland position, cannot obtain cheaply either Welsh, Scotch, or Guernsey granite, and is dependent on a supply from the Leicestershire quarries. Norway has during the past eight years been a strong competitor to the Leicestershire quarries; the granite from the latter district is mainly hard and somewhat close grained, wears well, but naturally wears somewhat smooth and slippery; Norway granite is more open grained and gives fairly good foothold, but it is therefore softer than Leicestershire granite. The finest granite for sett paving is Aberdeen granite; it is hard, but it gives as good foothold as granite from Norway.

The setts are usually from 5 in. to 7 in. deep, and are laid on a concrete foundation 6 in. to 8 in. thick; the joints are run in with pitch and tar and made quite impervious; the cost, including concrete founda-

tion, is about 12s. 6d. per yard super. The advantages of granite setts are that there is no paving equal to it for carrying heavy traffic; it is free to a very great degree from dust and mud: there is no side-slip. Its disadvantages are that it is exceedingly noisy, and where traffic is heavy and on steep grades requires sanding daily. It will stand heavy traffic, but there is one kind of traffic which can easily punish this pavement, and that is the traction-engine weighing 18 tons, hauling three loaded trucks, each weighing 12 tons; the steel strips on the driving wheels of the traction engine snip off the edges of the setts and destroy the appearance of the paving and its durability, and by increasing the space between each sett make the paving more noisy. All this could be avoided if traction-engine owners would use wheels filled in with rims of hard wood, but these are rather more expensive to maintain than the steel-rimmed wheels. I would stop this damage by putting a tax of £100 a year on steel-shod traction engines, and £20 a year on wooden-shod ones.

b. Wood paving is the most popular pavement for busy thoroughfares; it is the pavement which every ratepayer desires to have in front of his own premises, and, curiously, it is the most expensive. The usual foundation of 6 in. or 8 in. thick of Portland cement concrete, with a finely screeded surface to receive the blocks, is absolutely necessary. Almost every kind of wood has been tried, but during the past ten years Australian hardwood has been most largely used: it was greatly boomed by the Australian Government, and practically has almost ousted creosoted red deal. There are two principal kinds of this hardwood, jarrah and karri; the wood is very hard and very heavy, its specific gravity being higher than water, but it is rather brittle; the edges break away and cause the joints to appear wide, although the blocks are closely paved. It is, although so close grained and hard, a most extraordinary wood for expansion and contraction; its greatest drawback, however, is its slipperiness; to say that it requires sanding daily is putting the matter very mildly, some roads paved with hardwood in Nottingham, in certain conditions of weather, have been sanded five or six times daily.

The blocks are dipped in pitch and tar, and paved quite close, and a space left at the kerbs filled in with soft clay to take up the expansion.

The cost of jarrah paving is from 14s. to 16s. per square yard, depending upon the price of the timber, which fluctuates a good deal.

Those who have to maintain city roads believe that creosoted red deal will come into favour again, and in fact it has. Its cost is less than that of

hardwood: it costs less in sanding; and if the timber is good, sound stuff, and well creosoted, it will wear nearly as long as hardwood. The creosote preserves the life of the timber and is an antiseptic. No better instance of creosoted red deal paving could be given than the piece in front of the Nottingham Guildhall, which has been laid for twenty-two years, has not cost £5 in repairs, and is perfectly sound and not by any means worn out. No kind of uncreosoted wood could show a result like this. The cost of creosoted wood paving is about 13s. per square yard.

Wood paving in dry weather gives the most perfect foothold of any road except ordinary dry macadam; and, on the other hand, in some conditions of weather it is a veritable skating rink when covered with a greasy slime peculiar to wood paving. When in this condition the sprinkling of sand only increases the trouble, and there is only one cure—a thorough washing, which of course has to take place at night.

In very dry weather the dust from wood paving, although not large in amount, is particularly irritating; but this is caused by the pulverised horse droppings, which are more apparent on wood than any other kind of pavement. In dry weather the whole area of the wood paving must on no account be watered, unless you require a skating rink; the channels only should be watered with a cart, having the spreader arranged specially for this purpose.

A wood paved road fulfils requirement No. 1 as to foothold, No. 4 as regards side-slip only in dry weather; No. 2 as regards freedom from noise; No. 3 as regards dust and mud to a very great extent; and as regards requirements Nos. 5 and 6 it is costly to maintain and by no means cheap.

c. The third type of road is the ordinary, dry macadam road. This can only be used for urban roads.

The absolute necessity of a good foundation for a macadam road is as great as in the two types already mentioned, but in the case of the macadam road it is usually of hard ballast, well rolled. The granite should be of the hardest and toughest description, and from 2 in. to 2¼ in. gauge for roads of importance. Macadam's rule was that the stone should not be larger than you could put in your mouth. I would not care, myself, to trust to the accuracy of this gauge, and prefer a metal one. The stones should be rolled and rolled until they are dovetailed together as in a mosaic pavement, and no binding material should be used until this has been effected. It should always be remembered that the less binding material you use in consolidating your road the less dust and mud you will have afterwards. Road scraping should on no account be used for binding, it

has been mud and will speedily return to its original condition, fine granite only should be used for this purpose.

This road is the ideal one for foothold, for noiselessness, and for absence of side-slip. It will not carry heavy traffic, but it is cheap as regards first cost, a good road, including foundation, being made for from 2s. 6d. to 2s. 9d. per sq. yard; but this class of road is the one which has given rise to all the troubles since the advent of the motor car, as regards dust more particularly. Where the traffic is heavy, the process of taking off the mud and laying on the granite is almost continuous; where the ordinary traffic is light, and the motor traffic is heavy, the dust is a great nuisance.

d. A paving which is just now in its early experimental stages in this country is a paving called Durax. This paving is laid on a foundation of hard ballast, or, as it is expected to take the place of the ordinary dry macadam roadway, it is suggested that it should be laid on the top of the existing macadam roads, when the levels will allow of this being done. The material is granite, about 3½ in. cube. The peculiarity of the method of paving is that the cubes are not laid in straight courses at right angles to the central axis of the road, but in courses having a segment with a chord about 5 or 6 ft.; thus, if the road is 30 ft. wide, there are five or six of these segments in the width of the road. The stones or cubes are laid as close together as possible, and are well rammed with a light rammer. The syndicate having charge of Durax paving suggest that the joints should be filled with sand, but I prefer to fill them in with pitch and tar, as in the case of ordinary sett paving. The noiselessness of this paving is certainly most extraordinary: it is quite inconsistent with one's ordinary ideas of a paved road. There is no doubt that the segmental shape of the courses conduces to the noiselessness in a marked degree. The road gives good foothold, is free from dust and mud, there is no side-slip, and it will stand fairly heavy urban traffic; but the cost is somewhat heavy (about 5s. 6d. per square yard, exclusive of any foundation). Taking a road at 10 yds. wide, this price would equal £4,840 per mile run.

The syndicate believe that this road will supersede macadam roads in the country, and solve the dust and mud problem: there are nearly 27,500 miles of main roads in the country; what will our friends who still like to drive horses say to this length of paved roads? This class of paving may, after trial, be found to be useful on busy urban roads where ordinary macadam is objected to on account of the dust, but its first cost will prevent its universal adoption on all main country roads.

e. The last type of road is tar macadam. There is nothing new in tar macadam; it has been laid in this city for fifty years. The first piece of tarred paving in this country was laid on the London Road about the year 1845.

The material most favoured for use in making tar macadam is iron-stone slag, but I am certain that good results can be obtained by using certain kinds of granite. The advantage of using slag is that it is dry, and if the trucks in which it is delivered are sheeted down the material need only be slightly warmed before being treated.

I have often been asked for my prescription, which when given has sometimes been used by the patient with peculiar results. It was not the fault of the prescriber or of the patient, but the fault of the drugs used. There is nothing on earth which differs so greatly as the liquid called tar; good and poor qualities of tar are quite common, chemical analysis, so far, does not always help you, besides, the analysis of tar is rather an expensive matter, and unless you have every load analysed you are not certain, this analysis would add 50 per cent. to the cost of your material. Tar varies in quality at different gasworks, hence the futility of giving prescriptions of "so much tar to so much pitch," which in another town, buying tar from another gasworks would cause failure. But the same thing applies to tar from any works; it differs at the same gasworks at different seasons of the year. The tar from one gasworks is quite different to the tar from another works in the same town.

A different method in carbonising the coal, using a lower grade coal, and very often a change in the management, alters entirely the nature of the tar and renders it unsuitable for tar macadam purposes.

I and others, including my friend Mr. Hooley, are trying to standardise, if possible, this material, and if tar macadam is going to be used as extensively as some of us believe it will be, those who sell tar will have to sell it with a guarantee as to its constituents. I believe that nearly all the failures can be put down to the quality of the tar; those who have a free hand and can buy where they like can do better than those who must buy from one works only, and buy tar containing many things which are not required, and are harmful to the process of mixing and making tar macadam.

There are a good many kinds of apparatus for mixing tar macadam; but I do not, for obvious reasons, propose to describe these. The material when warmed and coated with tar is preferably stacked for a few weeks to mature, but this is not absolutely necessary. It is laid in two coats, the

lower one about 3 in. to 4 in. thick of material 2 in. to 2¼ in. gauge, and the top coat 1¼ in. to 1½ in. thick of material 1 in. to 1¼ in. gauge. The whole is well rolled and covered with dry granite chippings.

There are limitations to the use of tar macadam roads, and it is often laid down as a rule that this material should not be laid down on a gradient steeper than 1 in 18; in Nottingham there is a tar macadam road laid on a gradient of 1 in 10, and heavily laden drays pass down this road with safety; they do not come up; they could not, whatever the surface was laid with.

In certain conditions of weather the foothold is not all that could be desired, but if the sanding staff is well organised this difficulty may be surmounted.

The cost of a new tar macadam road, including foundations, etc., is about 3s. 6d. per yard super.

This road fulfils condition No. 1 as to foothold, except in very frosty or greasy weather; No. 2 as to noiselessness, also No. 3 regarding dust and mud; No. 4 in dry, fine weather, but in greasy weather is apt to encourage side-slip; for urban roads it fulfils requirement No. 5, and it is fairly cheap and fulfils requirement No. 6.

We have not discovered any road which fulfils all the requirements laid down, and I think we never shall.

2. I now come to the dust nuisance and the various remedies which have been tried to alleviate it.

a. The ordinary method of street watering: but how little effect this has on roads on very hot days in summer, when the temperature in the sunshine rises to 140° and the humidity falls to 45 as compared with 100 (complete saturation); watering in this condition of weather arouses in the staff a feeling of hopelessness and certainly a doubt as to whether the money so spent is not absolutely wasted. I am speaking more particularly of urban macadam roads and not paved roads. How would it be possible to water the miles of county roads? It is difficult in cities where the water mains are everywhere and standposts frequent, but on the county roads there are thousands of miles where there are no water mains, and it increases the cost enormously when the water has to be carted a mile or more from the nearest pond or dyke, there is also the risk that the latter may be dried up during hot weather just when watering is most required.

Water can only be used with economy and with moderate success when standposts are placed at intervals not exceeding ¼ mile. Road watering on an urban road under these conditions costs from ¾d. to 1d. per yard super. per annum.

b. Various oil preparations have been tried, with only moderate success, and have given place to materials of which calcium chloride is the principal ingredient. It has been known for years, that street watering with sea water is more effective than watering with the town water supply: after the water has evaporated, the particles of sea salt remain; these are deliquescent, always taking up moisture from the air and remaining damp. Calcium chloride is a saline body, much like sodium chloride, but more deliquescent, as, if some of the calcium chloride is exposed to the air for a short time, it attracts so much moisture from the air that it rapidly becomes a liquid. It is a bye-product at chemical works, is produced in enormous quantities, and ought to be sold more cheaply than it is, the present price being about 30s. per ton, plus carriage. It is applied in the usual way, by means of a water cart, the first dressing is a 10 per cent. solution, and the second a 5 per cent. solution. After the evaporation of the water, which is simply the medium by which the calcium chloride is applied to the road, the crystals are left on the surface and attract moisture from the air, keeping the surface of the road damp. Curiously, the greatest enemy of any oil process or calcium chloride mixture for laying dust is heavy rain, which washes the oil or calcium chloride from the surface of the road into the channels, so that the process of treating the surface has to be repeated.

I have found calcium chloride very effective, and its great advantage over ordinary street watering is that it ensures a road with freedom from dust for a week, although this depends a good deal upon the amount of the traffic.

The cost of treating roads with calcium chloride is about 25 per cent. less than ordinary street watering, but the comparison is hardly fair to calcium chloride for the reasons given above.

c. Tar painting, or spraying, of roads has been strongly urged by its champions as being the only cure for dust. The Roads Improvement Association and the Automobile Club offered prizes last year for the best method of laying dust, and very extensive trials were made on roads near London. I saw some of these trials and have given the subject very careful attention. The roads upon which the trials were made were absolutely free from dust before the trials, and there was no dust afterwards, because there was no sunshine and plenty of rain. The trials proved nothing.

I would like to see tar-painting or spraying tried in a hot, dry summer, when the system could be carefully tested. I am bound to say, however,

that some surveyors speak very highly of it, and one surveyor in the South England has given an order for the tar-treating of 150 miles of road, so that there will be opportunities of watching this process if the weather is dry and favourable.

One great drawback to tar-painting is that in winter, after frost and snow succeeded by continuous but not heavy rainfall, the road is coated with a black, slimy mud, which is very difficult to remove.

Tar-painting is expensive: from figures obtained from those having experience, the cost is from 1d. to 2d. per yard per annum. This is the opinion of the County Surveyor of Kent, who says: "If all the county roads are to be tar-painted the cost would be a million a year, and about 34 million gallons of tar would be consumed, of a value of about £280,000." What a windfall for gasworks! And how long, in view of such a demand, would tar remain at its present price?

Taking the cost at only 1d. per yard per annum, and the roads at an average of 10 yds. wide, it would equal £73 per annum. I believe the average cost of the upkeep of county roads is only £60 per annum, and, therefore, the cost of maintenance of the county roads would be more than doubled if they had to be tar-painted in order to lay the dust.

3. I come now to the third requirement: what road will most effectually combat the dust and mud nuisance? I believe that the only road which will effectively do this is some kind of tar macadam road, which could be made very cheaply if some of the enormous heaps of slag and granite which are now waste material could be used, and if tar could be standardized and delivered to the user in a state fit for use without resorting to hours of continuous boiling.

I have already said that a tar macadam road would cost about 3s. 6d. per square yard, but this is for an entirely new road, and includes excavation, foundation, etc.; many roads have fairly good foundations, and these could have the coat of tar macadam laid on the top, using the present macadam as a foundation.

4. What would it cost, and who should pay for it?

I believe that treating the county roads as suggested would cost £1,000 per mile. There are about 27,500 miles of roads in England and Wales, there is, therefore, an expenditure of 27½ millions to be faced: how is that money to be found? the easiest answer is that the State must find it, and I intend to shew by what means the State could raise money for assisting road authorities.

What has brought about the trouble regarding the upkeep and main-

tenance of urban and country roads? The answer is, the motor car and other self-propelled vehicles. Road engineers are frequently told that they know nothing about the maintenance of roads, and that road surfaces are not brought up to everyday modern requirements; but road engineers might with equal truth say, that motor cars are quite as imperfect, and that the ingenuity of man could not devise a more efficient dust raiser than the modern motor car, with its low body, trailing leather splashboards, and excessive speed.

As a road destroyer, the motor car in some conditions of the weather is unequalled, as after slight rain, just drying, or worse still, after a sharp frost succeeding wet weather quickly and followed by a sudden thaw, a heavy motor car travelling at 30 miles an hour will make grooves 5 inches wide and ½ inch deep in an ordinary macadam road, yet some people say motor cars do not affect the roads prejudicially. We are not all motorists, and as they are primarily responsible for the present trouble on urban and country roads, is it unreasonable to ask, that either the construction of motor cars should be improved to prevent the damage they do to the roads, and worse still, the inconvenience they cause to the general public, more particularly to the owners of and residents in houses abutting on those roads, or that the owners of the cars should at any rate help to pay for converting the roads to their use? Surely people who can afford to pay from £800 to £2,000 for a motor car, and from £200 to £600 a year for its upkeep, can afford to pay a tax for their use of the roads, by which they absolutely take away all the pleasure which the ordinary pedestrian or driver of a horse used to find on the public highway.

I quite agree that the advent of the motor car and other self-propelled vehicles has done some good, not only as regards urban but country roads. The old methods adopted by some Rural Councils of repairing roads with any kind of soft stone and binding it together with refuse obtained from wayside ditches has, it is hoped, gone for ever.

I believe that motor cars, motor vehicles, traction engines, tractors, and in fact every self-propelled vehicle which is firstly a public danger, and which secondly affects the public highways in such an extraordinary degree, should pay something.

Just look for a moment how severely handicapped is that self-propelled vehicle, an electric tramcar. Take a system operated by a company, say at Bristol: they have to not only make, but maintain, the paving of the road they run over; and they do not wear it out as they do not touch it. And they also pay rates on their buildings, plant, and track as any

ordinary business concern does. Compare this with the case with which an owner of a traction engine can pass into a neighbouring county by paying a fee of 2s. 6d. and do £500 worth of damage.

Road engineers can make roads practically dustless, with a surface to suit the motorist and to stand fairly heavy traffic, but it amounts to a reconstruction of our country roads. This will cost money, and cannot be done without both rates and taxes. It would require that the ordinary rates for maintenance would be about doubled, and this would have to be supplemented by a sum of money being found from other sources, and the only source which will occur to most people is a tax on self-propelled vehicles. Mr. Asquith, the Chancellor of the Exchequer, stated last year when propounding his Budget that this tax had been suggested to him, and there is no doubt in most people's minds that such a tax will have to be imposed. There are at least 60,000 or 70,000 self-propelled vehicles in the country, and a tax of £20 per annum would realise from £1,200,000 to £1,400,000; this should be collected by the State and handed over to the various authorities in proportion to their mileage and requirements. At the conference of Road Engineers and Road Users held last year under the auspices of the Municipal and County Engineers and the Roads Improvement Association, a resolution was carried, I believe, practically unanimously that "a further tax beyond that at present imposed should be levied on self-propelled vehicles as a means of providing revenue for road maintenance purposes."

If, therefore, the present cost of the maintenance of roads in the counties is put at $1\frac{1}{2}$ millions, and an additional 1 million is obtained from rates, and, say, $1\frac{1}{4}$ millions from a tax on self-propelled vehicles, a sum of $3\frac{3}{4}$ millions per annum would be available, and with this sum the condition of the roads could be altered, not so as to make them perfect, but it would render their condition such that the present intolerable dust nuisance would be stopped. The change could not be made in a year or in five years, but would be one of gradual growth, and the roads ought to be under some general system of inspection and control, so as to insure that the money was spent on some system that would give the maximum amount of comfort for a minimum amount of expenditure.

I am disinclined to suggest Government control, but rather a control of some board of engineers who have had large experience practically as road engineers.

This subject of improvement in roads is not a political one, and hence perhaps it has less chance of serious attention by governments, whatever

their politics may be, but when other matters have been settled let us hope they will be able to spend a short time in dealing with this question of roads improvement as a subject of national importance.

E. PURNELL HOOLEY, M.Inst.C.E.

THE subject of Present-day Road Requirements is one of the most aggressive questions of the day, and at the present time the County of Notts is suffering to a greater extent than the majority of other counties in England, outside the London and Home Counties, in consequence of the altered requirements of the main roads through the advent of self-propelled traffic.

Nottinghamshire is a central county, and it is of interest to point out to those who are in touch with such figures, that there are at the present time registered within a radius of 50 miles of Nottingham no less than 528 motor lorries, practically 8,000 pleasure cars, and over 9,000 motor cycles, or over 17,000 of these road damagers: and seeing the Great North Road traverses the county from end to end the amount of foreign car traffic is simply enormous, as many as 28 cars per hour travelling over this one road during Doncaster race time.

Then again there are no less than 13 heavy traction engines licensed to be used on the highways in this county, and 223 traction engines unlicensed which are used for agricultural purposes only, although why not licensed it is somewhat difficult to appreciate, as these are almost always hired engines; and I cannot understand why any distinction is made in the matter, as the owner of the engine alone reaps the benefit of the exemption from licence.

But to add to this, last year Notts has been inflicted with the visits of 535 outside traction engines, which have visited the county with daily licences, being fully licensed elsewhere. It seems ridiculous, but a large number of these visiting engines are used in drawing roundabouts and such-like forms of amusement, which can be practically of no benefit to the public at large.

Recently one of these amusement engines passed through Notts on one of the weakest and ordinarily little used main roads, paying a fee of 2s. 6d. It seemed on inspection as if the driver had gone out of his way to do as much damage as possible, for the cost of reinstating the road

after this one journey, the engine and trucks cutting right through four inches of road face after a slight frost, has been £55.

Leaving traction engines out of the question for a moment, there are in the City of Nottingham and County of Notts alone—

19	heavy motor cars,
694	motor cars,
719	motor cycles.
1,432	

And with these figures in front of one, it does not seem possible or sensible to continue to repair roads as they have been repaired hitherto, when it is well known and admitted by every qualified surveyor that ordinary maintenance is impossible to cope with the traffic, for it is seen on every side that each self-propelled vehicle, especially when fitted with studded tyres or serrated wheels, passing over the road, damages, if not entirely tears up, the road surface.

It is often stated that a motor car does no more damage than an ordinary farm cart, but when it is understood that a farm cart may possibly travel two, or at the outside ten miles on a road, a motor car will in the same day travel nearer 100 miles over the roads: if it only *does* as much damage as one cart, it must be seen that the damaged area must be ten times as great, and in consequence the whole road area costs ten times as much to keep in repair.

For many years past there seems to have been a tendency, at any rate until the county councils came into existence, to allow the main roads of England to a great extent to deteriorate, because road traffic generally had given way to railways, etc., and even where this deterioration did not take place, by their history and construction the roads have proved since they are unsuitable to bear the present type of traffic. And yet we still hear of the magnificent roads of our forefathers, and fairy stories are told —"they would bear any traffic." But, I ask, where are those magnificent roads we hear talked about? No reliable history proves that those roads were anything like as good as the roads of seven years ago, but if those roads of, say, fifty years ago, had been called upon to bear the present-day traffic, I am certain there would have been a much louder outcry (if not actual acts of violence perpetrated) in consequence of the interference with the public rights, and the annoyance caused through the action of our present road destroyers.

So great has this self-propelled traffic made headway that there are few who do not remember the days when it was an exception to find any self-propelled road vehicle on the roads at all, and now it is almost impossible to travel two miles in the country without either being brought face to face with a road that it is almost impossible to drive over, through the damage done by traction engines, or else it is impossible to walk on the main roads without being covered with dust.

Everyone calls for some alteration to take place, but when the question of the cost of that alteration is brought forward, those who have previously been amongst the loudest to call for alteration content themselves with grumbling at the cost, or else entirely collapse, and it is too often left for the official who has to deal with the trouble to fight his battle alone.

Hitherto roads have been constructed to meet the light requirements of ordinary traffic, but there is no doubt that in the future roads must be differently constructed.

Light motor traffic has made too firm a hold to be stopped because some of the public are inconvenienced by its use, for certainly business can by its means be carried on more expeditiously.

In the years 1861, 1878, 1896, 1898, and 1903 the Government brought in Bills which practically meant the encouragement of traction engines and motor tractors on the highways, but most unfortunately have not given any relief to the taxpayer in aid of the damage done by this addition, other than the fees, which in a county like Notts hardly amount to the cost of the damage caused by one traction engine in a journey of twenty miles during a bad time of the year.

The idea that the motor tractor and traction engine would become a universal benefit has not been generally justified, and the result has most assuredly shown, up to the present at any rate, that the one person who has received benefit by the use of these modern road destroyers is the owner of the tractor or traction engine, with but little good to the general public.

As I have repeatedly pointed out, beer is no cheaper because it is sent by traction engine, nor does bread seem to decrease in cost, because the flour is sent out by similar means, and it is not generally known, but it is nevertheless a fact, that when these traction engines are used on the highway for the purpose of conveying manure to farms, the owner of the traction engine, because he is stated to be engaged in agricultural work, does not have to pay even the modest licence of £10 now enforced for his

engine; it has been held that the conveyance of farm manure is not extraordinary traffic.

It is nevertheless a fact, that in the County of Notts there is one engine employed on this work that does as much damage as any other four or five traction engines in the county. Usually this engine proceeds to work its chief destruction at the time of the year when the roads are least able to bear the strain, *i.e.*, in the months of December, January and February, and yet if any other system of road repair is suggested, that would possibly, and does in reality stand this traffic, the first person to cry out against any altered systems of road management is generally the farmer who has been employing these traction engines for the delivery of manure to his farm, and has very possibly written complaining of the condition of the road adjoining his premises.

To make further use of these road destroyers, it has been repeatedly suggested that these traction engines should be employed for the conveyance of road repairing material, as well as for the conveyance of manure, etc., but when tenders are asked for this work, the price has invariably not compared satisfactorily with the ordinary horse-carting prices of the district.

I hope I have said sufficient to show that County Councils are not to blame for the added cost of road maintenance, but the Governments are to blame for allowing the traction engines to do the damage they do, and not giving the public the wherewithal to repair the damage done by their action.

In endeavouring to meet this altered traffic on our roads in the County of Notts strides have been made in endeavouring to bring about a different system of main road management: in all about ten miles of roads have been constructed of Tarmac, and these roads have so far stood the traffic of traction engines, as well as motors, in a most satisfactory manner, and have gone a long way to minimise the dust nuisance: although the dust question is not one that some people think the County Councils should have to deal with first. That roads should be constructed of a dustless material I quite agree, but whilst horses use the highways, and the adjoining roads are constructed in the present unsatisfactory manner, and there is no restriction that can stop the needless damage to roads by drawing out soil from the land, so long must there be a great deal of dust. Many endeavours have been made to discredit Tarmac by stating it is slippery, though it is well known it is only slippery when frost and rain succeed each other so quickly that the road face has not time to

dry. To try to keep peace, in many places the Tarmac roads through the winter have been kept dusted with outside chippings that make dust, and in consequence, later, when the face is quickly dry, unfair critics have said the road is as dusty as other roads, instead of being in its natural state free from dust. On this dust question it has been held by the Local Government Board, where inquiries have taken place, that the duty of laying dust by watering is a sanitary matter, and not chargeable to the County Councils, except where water is used for the purpose of road maintenance. It is necessary to consolidate by the application of water any road face that has been broken up either by the traffic or by the weather, consequently only a portion of the cost of watering can be charged to the County Council; but whilst the cost of dust laying is not a County Council charge, the making of roads in a sensible manner to avoid dust as far as possible is surely the duty of all road repairers, and in roads so made the watering cost is reduced to a minimum.

It has been truly said that weather is the best road-maker, and it may be added road-destroyer also. If the season is a severe one, the first self-propelled vehicle that passes over a road constructed of the ordinary macadam has a tendency to disintegrate the surface, and allows the road to become wet through to its under formation (I say formation, for few country roads have any real foundation). This is the preliminary step, and if that self-propelled vehicle happens to be one of many motor cars, and is followed later by a traction engine, the fate of the road is assured and a collapse almost certain. In my opinion the motors act as the key does to the door, and traction engines push it wide open, with the result that the road becomes in the near future absolutely useless for ordinary traffic.

There are roads in the county of Notts that previous to ten years ago had possibly ten or 15 vehicles passing over in a day. These roads have now to bear as many as seven traction engines, and possibly fifty or sixty motor cars passing over per day. And whereas some of the roads used to cost about £50 per mile they are now costing nearer £150, but no relief comes from the Government.

There are many who are well able to appreciate that traffic such as this can only be dealt with by a far different system of road management from that which has hitherto been practised.

I have tried every system of road making that it is possible to try, and have come to the conclusion that the only possible means of making a reliable road, suitable for all classes of traffic at all times is that which

has been carried out by the County Council of Notts on the Radcliffe Road, part of the Mansfield Road, and in several other parts of the county.

It is difficult to point out how roads can be dealt with unless one goes into details, but it may be sufficient to say that there are roads in the County of Notts without any ballast foundation other than what has been from time to time placed therein by the County Council. To ballast the roads with a 6-inch hand-packed foundation, and to place thereon a minimum of 4 inches of road surface, would cost about 4s. per square yard to form, and this 4s. per square yard would amount to at least £2,800 per mile, and even after such a road has been constructed the surface would, with the present traffic, require renewing in many cases at least once every three years at a further cost of from 9d. to 1s. per yard super. for each dressing. This would, I am certain, frighten even the most callous and wasteful would-be expenditor of public money. To obviate this, I am convinced the only possible and sensible way is to do any forming that may be required to a road by a coating of rejections slag, and give the same a coating of (as has been done on the Radcliffe Road) Tarmac averaging from 3 in. to 4 in. in thickness, at a cost of 2s. 6d. per yard super.; for, after five years' wear, sections of this road have been taken up and examined, and although the road at times has had to bear heavy traction engine traffic, it is not possible to discern more than half an inch of road surface has been worn away, whereas if ordinary granite had been used there would have been little trace of the surface left by this time.

Thus the road I strongly recommend is known as a Tarmac road, and, laid as stated, has cost practically 2s. 6d. per yard super. to form complete. This class of road laid adjoining the Midland Station at Newark has been proved to last nine years with practically no cost in material for repairs and a minimum in cleaning. Roads that previously had been coated each year with granite at a cost of 1s. 6d. per yard super. have been faced with Tarmac at a cost of 2s. 6d., and have stood at the present time six winters, with practically no repair, and yet there are many who will not see that this means lasting economy.

It should be pointed out that tarring up ordinary slag or any other inferior material does not mean making a good road surface. The failure in the past of tarmacadam (where it has failed) is that the material used in its manufacture has been wrong, but it is claimed for Tarmac that the causes of these failures have been got over.

It is difficult in a short paper to go more fully into the points which I have raised, but I would urge that County Councils and their officials be given credit for having attempted to do something towards dealing with the present extraordinary position of affairs, and not to imagine that because efforts are being made that those who are making the efforts are doing so for any other object than for the good of the public in general, and when criticising to remember that it is not possible to bring about such enormous alterations as are now required, in a few moments. In Notts, at any rate, every effort is being made, not a point is being missed, and if the public could only appreciate that the one mile of road they generally travel over is not the only mile of road in the county, they would be going far to assist those who are trying to meet the difficult position which has arisen in a sensible and economical manner.

Mr. Brown has dealt with the requirements of town roads. He agrees with me in my contention that ordinary macadam roads are out of the question with present traffic, that even granite setts will not long stand traction engines constructed with their serrated wheels passing over them, and that where he has used even ordinary tar macadam he is satisfied with the result.

Col. Denison (Chairman of the Highways Committee of the Notts County Council) spoke of the changes which had occurred owing to the advent of the motor-car and the enormous increase in the amount of heavy traction on the roads. It was contended that these vehicles did not do any harm to the roads, but opinions were undergoing a change on that point, for it was obvious that the rate the vehicles travelled must of necessity loosen the material composing the surface. The great cause for complaint had been that they had had no power to prohibit the use of heavy engines at any time of the year, particularly after a frost. Mr. Brown had suggested a system of levying taxes on heavy motor and traction engines. Whether that was the best course to adopt or whether they should get a certain fixed sum from the National Exchequer he was not prepared to say: but it was clear that the damage done to the roads was not paid for by the people who were responsible for it, and until that was done he did not see how they could satisfy the general public. He was a believer in Tarmac. The only drawback to it of which he was aware was its slippery character in frosty weather, but he thought they could arrange to distribute material on the surface to obviate that danger. They could not use Tarmac all

over the country. It cost a great deal to put it down, though very little to maintain. If they were to provide a remedy for the present state of affairs they would have to spend a considerable amount of money.

Mr. G. W. Hawley (Basford) said that if the classification given by Mr. Brown under the first six headings could be realized it would simply be perfection, and so far as road making is concerned the millenium would have arrived. Undoubtedly, the repairs and maintenance of roads to bear the constantly increasing traffic was the all-important problem to surveyors, general public and the long-suffering ratepayer. The character of the traffic since the advent of motor cars, motor lorries, and heavy traction engines with their attendant heavily-loaded waggons attached thereto had entirely changed, the heavy weights putting a severe strain (in many cases) which the roads were unable to bear. This not only affected main roads, but many district roads were getting equal traffic, and it was affecting rural districts very considerably.

Very few, if any, either main or district roads, were constructed with rough block foundation to resist the pressure now put on them, such traffic was never anticipated, consequently the roads want practically remaking. Many of the roads must be widened, as in the old days the macadamised portion was only 14 to 16 feet wide.

The cost of maintenance was on the increase and was bound to continue so, materials in his own district increased during the last ten years twenty per cent., the proportion ten years ago being seven slag to one of granite, now seven slag to two of granite. He was personally strongly in favour of tar macadam (except for steep gradients), in preparation for this form of surface undoubtedly it was necessary to coat with slag to get a sufficient foundation. Much prejudice and strong feeling was expressed against tar macadam by those who rode and drove horses, and of course a strong representation of these was to be found on rural councils. The difficulty of dealing with tar macadam in frosty and greasy weather was great, especially the former, for early morning traffic, milk carts and market produce coming to town. This might be overcome by a rotary sand-spreading cart being used. The horses should be shod with indiarubber pads for travelling. Sufficient quantity of sand and grit would be placed at stated intervals at the roadside for replenishing the load, this would mean probably a horse and cart for each length of 8 to 10 miles.

The whole question would be one of cost, surveyors would have no difficulty if they were supplied with the funds. Self-propelled vehicles of all kinds should pay a higher tax, to go towards repairing the damage which they cause. Grants should be made by the State to each road authority, according to the mileage and ratio of roads as to the traffic over them.

Mr. G. Green (Wolverhampton) was of opinion that tar in one form or another, either applied as a matrix for the binding together of the material, or as a surface dressing, or in the form of tar macadam, was the best and the cheapest way of dealing with the dust problem. From his experience he found that this added to the life of the roads, as well as preventing the spreading of dust and the making of mud. It appeared to him that motors and traction engines, however objectionable they might be from a road point of view, were necessary for the requirements of the twentieth century, and as such it became the duty of a road surveyor to make roads to suit the modern requirements. The result was chiefly a question of cost. If they had money they could easily make good roads. Each surveyor, therefore, had to make the best roads that he could afford with his annual allowance for this purpose. He had made a very satisfactory road by applying pitch and tar, in the form of grouting, to a slag road, rolled dry, which worked out considerably under one shilling per yard super.: and he was able to lay tar macadam at about two shillings per yard super. He pointed out that Nottingham had always been to the front in the making of good roads, and he remembered tar macadam roads in that city twenty years ago, and now he supposed that Nottingham had more tar macadam roads, in proportion to the road mileage of the city, than any other town in the country.

Dr. P. Boobbyer (Nottingham) said that he had been asked to close the discussion by saying a few words on the medical aspect of the subject of road requirements of the present day, with special reference to the new situation in this regard created by motor traffic. In the first place, however, he wished to enter his protest as a simple citizen against the monstrous selfishness of the motor car driver and owner, and the intolerable nuisance and danger caused thereby to the public.

But now, to turn to the medical aspect, he must remind the meeting that dust was both organic and inorganic matter, of extremely variable composition, in a fine state of division. The specific viri of various infectious diseases were particulate matter, and frequently reached their victims in the form of dust. To take a very common example: the epidemic diarrhœa, which caused such frightful mortality among the infants, and especially the hand-fed infants, of the poor, was in great measure a dust disease. The fæcal organism which caused the complaint reached the child's food mainly as dust.

When one reflected on the almost innumerable and injurious constituents of the dust of so-called civilized communities, and it was with such he was principally concerned that day, the sweepings of streets, houses and workplaces, the dried urine and dung of men and other animals, the expectoration of persons with various complaints of the lungs and air passages, and many other items which one's fancy could paint, the necessity for keeping the production and the

raising of town dust within reasonable limits, in the interests of public health and comfort, became at once apparent.

We should inhibit, he said, as far as possible, the dissemination of fæcal and other infective, poisonous, and irritating material, our public scavenging should be above reproach, and we should aim at making our roadways as nearly chemically-cleanable as possible without undue friability or slipperiness.

Mr. A. N. Bromley also took part in the discussion.

ANNUAL MEETING OF ASSOCIATES.

ADDRESS

By H. P. BOULNOIS, M.Inst.C.E.,

(FELLOW).

On "HOUSE REFUSE: COLLECTION AND DISPOSAL."

SCAVENGING, or the removal of organic refuse, was one of the earliest hygienic movements amongst primitive people when they first began to herd together.

Many of the Mosaic laws were in that direction, and even in the days of primitive man there was some attempt at cleansing the rude habitation, as relics of the Stone age reveal the "middens" where empty shells and other refuse were deposited.

One of the earliest historical references to the value of such removals of refuse may be found in a book by a Dr. Casius, published in 1552, after one of those terrible outbreaks in this country of the sweating sickness (believed to have been an aggravated rheumatic ague fever), wherein he gives some remedial measures, inclusive of the following: "Make a sweet house by cleansing it and removing the rushes and dust, and improve the air outside by filling up ditches, removing carcasses, mending with earth all muddy and rotten ground, burying the dead, keeping gutters clean and sinks, removing dung-hills and ill-smelling things."

He somewhat mars this excellent advice by giving some prescriptions for most ridiculous and disgusting medicines, one of which was live earth worms boiled in oil.

With regard to rushes, we read that in those days the streets including London were covered with clay and rushes, undisturbed for twenty years, "concealing a mass of filth not fit to mention, and exhaling a foul vapour not wholesome for the human body."

We learnt thus slowly the great lesson that the speedy removal of all offensive decaying organic matter is a great step in the direction of improved health.

Some years ago the late Sir Robert Rawlinson, then chief engineering inspector to the Local Government Board, said at a meeting at Stratford-

on-Avon: "The foundation of all sanitary science is scavenging, and if I was asked what is the most important feature in sanitary science I should again repeat scavenging. Sewers, drains, and water supply, are all of secondary importance if scavenging is neglected."

This, if it were needed, is my excuse for speaking to you to-night on what is really not a simple subject. I think I have shewn its claim to prominence and its importance as a factor in the health administration of our towns. Although great strides have in recent years been made in the methods adopted for refuse disposal (of which I shall presently speak), there does not appear to have been much universal improvement in the methods of collection or in temporary storage. The ashpit still exists in many districts, and the collection by open carts and ladders and baskets is still in our midst.

The amount of "house refuse" which has to be collected and disposed of in any town is roughly about a quarter-of-a-ton per head of population per annum.

A cubic yard of refuse varies in every town, and also according to time of year, from about seven-eighths of a ton to one-and-a-quarter tons. It is always heavier in winter, wetter and more coal.

To give you some idea of what this means, take Greater London with its estimated population of seven-and-a-quarter millions. A year's collection would mean an heap of refuse sixty feet high, filling from house to house about fifty miles of streets.

Some towns do not keep any very clear statistics, but I have been able to obtain some from the City of Liverpool for the year 1907, as follows:

339,000 tons of refuse collected and disposed of as follows:

68,000 tons sold to farmers and brickmakers;

63,000 tons still taken to tips;

41,000 tons barged away to sea;

167,000 tons burnt in destructors.

A daily average of eight hundred and fifty men employed in this work.

This work of cleaning and collection and disposal is under control of the city engineer, assisted by a chief superintendent, and a chief outdoor superintendent. The city is divided into twenty-two districts, with an inspector for each district. There are also two divisional inspectors for the whole city who look after the inspectors and men. Streets are swept once a day, and where imperviously paved are washed with horse and jet twice a week, some of the principal streets are thus washed every morning very early and swept with horse brooms. Orderly boys are employed all day in these streets. In the poorer districts the streets and alleys are

washed at least once a week. Gullies throughout the city are cleansed and flushed at least once a fortnight.

Ordinary ashpits are collected once a month, but the corporation are gradually abolishing these and substituting special ashbins.

Tradesmen's refuse is collected in the ordinary way, by "bell carts," but the Council now have better bins placed in the streets.

In 1904 a system of collection of waste paper from business premises was introduced; during 1906 447 tons were thus collected, and sold for more than cost of collection. With regard to open ashpits, it is interesting to note that before 1900, when the "bin" was introduced, there were approximately 65,000 of these, nearly all open and averaging twelve square feet in area; this means a total area for the city of eighteen acres of ashbins.

The number of ashpits has been now reduced to about 41,790, notwithstanding new houses.

It is now fairly accepted that the best method for disposal of refuse is that of burning in so-called destructors, and if properly constructed and properly worked no nuisance is caused thereby.

Developments have been considerable since the introduction of the "Fryer" destructor, such as:

1. Increased temperatures;
2. More refuse per cell burnt;
3. No vapours of distillation perceptible;
4. Better draught and more complete combustion:
5. Dust now arrested;
6. Harder clinker produced;
7. Less handling of refuse;
8. No "stewing" before combustion;
9. Better methods for cooling clinker;
10. More commercial value of heat generated.

At Liverpool there are 7 destructors: total number of cells 59; capable of destroying 3,700 tons a week.

Lavrock Bank Destructor, erected 1903, has 8 cells: each cell will burn 13 tons a day of 16 hours; temp. 2000°; 4 boilers, evaporating 36,000 gallons of water a day with steam at 160 lbs: drives electric generating plant of 800 h.p., producing from 6,000 to 7,000 Board of Trade units a day.

From five district stations no less than 9,209,369 units generated last year, which, at 1d. per unit, = £38,372, but only ¼d. charged to Tramway Dept. of the Liverpool Corporation.

Various methods have been tried to obtain a commercial value from house refuse without "sorting," which process, for obvious reasons, should not be resorted to.

There are two recent developments of this which I will briefly explain:

The first is the Lightning Dust Crusher. This machine consists of a high-speed centrifugal-force disintegrator, pulveriser, and mixer combined.

The hammers, weighing about 50 lbs., are 4 or 6 in number, and are composed of a special alloy steel, and are contained in a comparatively small steel core or box. The axle on which these hammers are hung revolves at a speed of about 1,000 revolutions a minute. The refuse, tins and everything, is fed by shovel into a hopper, and passes through the machine at a rate of from 4 to 5 tons an hour, and comes out completely pulverised in the form of a mould or powder.

The driving power required oscillates between 18 and 22 i.h.p.

A mechanical conveyer feeds the powder into carts or railway wagons as may be required.

The cost of a machine, with an electric 40-h.p. motor and conveyer, is stated to be about £800. With a suction-gas plant and engine the total cost is said to be about £1,000.

At the installation at the depot of the Southwark Borough Council, there are two machines at work (and the Council are going to install 2 more), the cost of thus treating the refuse is 1s. 5d. per ton, not including depreciation of plant.

It is taken to farms in the country at a further cost of freight of 1s. 8d. per ton, total 3s. 1d. per ton, and sold for 2s. 3d., so that the net cost = 10d. per ton.

The second is Coalesine. This is a process by which the powdered house refuse is made into briquettes for burning as a fuel in furnaces: the powdered refuse is mixed with some sort of tar product, is said to become innocuous, and is pressed into briquettes of 9 in. by 4 in. by $2\frac{1}{2}$ in. A pound weight of these briquettes evaporated 3·33 ($3\frac{1}{3}$ lbs.) of water, a pressure of 40 lbs. per sq. in. being maintained in an ordinary Lancashire boiler. It is said to cost only four shillings a ton, which is of course much less than ordinary furnace coal of a very cheap character. It is the invention of Mr. H. G. Coales, Surveyor of Market Harborough.

The Address was illustrated by a number of lantern slides.

NOTES ON LEGISLATION AND LAW CASES.

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AIR.—*Easement—Nature of Right—Derogation from Grant—Obstruction.*

A right to the access of air to a defined aperture over a servient tenement may be acquired though there is no defined channel over the servient tenement through which the air flows.

The grant of such a right may be implied from general words in a conveyance of a building from a grantor entitled in fee to the adjoining land though such land is subject to a lease.

On January 19, 1905, the H. Company conveyed to the plaintiff in fee a piece of land with a stable on it. The stable was ventilated by apertures to which the air had access over an open yard which the company owned in fee subject to a lease for a term of which twenty-eight years were unexpired. On August 3, 1905, the company conveyed the yard to the defendant, the lessee joining to merge the term. The defendant put up a hoarding entirely closing the ventilators of the stable:—

Held, on the principle of derogation from a grant, that neither the company nor the defendant as their assignee could erect anything on the yard which prevented the use of the stable as a stable. A mandatory injunction granted to remove the hoarding.

Cable v. Bryant. Neville J., 259 1 Ch. February, 1908.

LONDON.—*Drain or Sewer—Nuisance—"Intimation" Notice-Service on Person not Liable—Compulsion—Recovery of expense of abating Nuisance.*

A nuisance having arisen from the obstruction of a pipe which carried off the drainage from the plaintiffs' premises, the defendants' sanitary inspector served on the plaintiffs an "intimation" notice, under the Public Health (London) Act, 1891, requiring them to abate the nuisance. The plaintiffs contended, and it was the fact, that the pipe was a sewer, and therefore repairable, not by them, but by the defendants; but the plaintiffs did the work necessary to abate the nuisance under protest, and sued the defendants to recover the expense incurred by them in so doing as money paid by them under compulsion, which the defendants were compellable to pay:

Held, that the plaintiffs were entitled to recover.

Oliver v. Camberwell Borough Council, (1904) 68 J.P. 165, distinguished.

Wilson's Music and General Printing Company v. Finsbury Borough Council. Channell J., 563. 1 K.B., March, 1908.

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SEWER VENTILATION AND THE INTERCEPTING TRAP.

By FRANCIS J. H. COUTTS, M.D., B.Sc., D.P.H., F.C.S.,
Medical Officer of Health, Blackpool.
(MEMBER).

And JOHN S. BRODIE, M.Inst.C.E.,
Borough Surveyor, Blackpool.
(MEMBER.)

Read at Sessional Meeting, Blackpool, March 13th, 1908.

F. J. H. COUTTS, M.D., B.Sc., D.P.H., F.C.S.

THE subject of sewer ventilation has been so frequently a matter of discussion that I may offer some apology for bringing it forward. Firstly:—I might premise that it is not very easy to find subjects for discussion which are equally interesting to the engineer and to the medical officer of health. Secondly:—The question of sewer ventilation is of such vital importance, that so long as there is any marked difference of opinion on it among sanitarians, it must constantly crop up for discussion. We are very far from agreement, and until something resembling unanimity is obtained among those versed in sanitary matters, we cannot be surprised if local authorities object to carry out schemes which may be recommended to them, especially if these involve considerable expenditure. Thirdly:—Very important light has been thrown on the subject by some interesting and valuable experiments recently recorded, and it would be distinctly of advantage to have the matter thrashed out again, so that the bearing of these new facts may be realised and our mental attitude to the subject readjusted, if necessary, to somewhat changed conditions.

I am not sanguine enough to believe that the present discussion will finally solve the problem and lead to that unanimity of opinion which is so highly desirable, but I am led to hope that, along with others, I may derive much benefit from it.

Our attitude towards the question of sewer ventilation is, of course, very greatly influenced by the views which we hold as to the dangers threatened by sewer air or sewer gas.

Apparently as far back as Roman times a strong opinion was held as to the dangers of sewer gas, for I have seen it stated that in Justinian's Digest, A.D. 555, the following words occur:—"The Prætor took care that all sewers should be cleaned and repaired, for the health of the citizens, because uncleaned or unrepaired sewers threaten a pestilential atmosphere, and are dangerous."

But in more recent times very considerable doubt has been thrown upon the power for evil of sewer air, although most people have appeared to agree about the potential harmfulness of sewer gases, or gases given off by stagnant and decomposing sewage. The experiments which seem to have most strongly influenced recent views are those of Mr. J. Parry Laws and Dr. Andrewes on the micro-organisms of sewage and sewer air, which appeared to indicate that sewer air had no power of taking up bacteria from the sewage with which it was in contact, that, bacteriologically, the air of sewers was no worse than that of the street above, and that, in fact, the number of micro-organisms found might actually be less, whilst the types of germs were precisely those present in the external air, and not those of sewage. They never found the *Bacillus coli communis* in sewer air, although it is present in such enormous numbers in sewage, and they thought the possibility of the existence of the typhoid bacillus in the air of sewers was very remote.

The full deductions from these results were too startlingly different from the teachings of practical experience to allow them to be accepted unconditionally. Nevertheless, these experiments have undoubtedly led to a considerable amount of uncertainty, and many people have gone so far as to controvert some of the older views as to the connection of diphtheria, typhoid fever, scarlet fever, septic sore throats, etc., with the inhalation of sewer gas.

Their reasonings have, however, failed to convince many of us as to the innocuousness of sewer air. I have been strongly impressed by the firm opinions held by many good observers who have had long experience in general medical practice, and who have unhesitatingly expressed their belief that certain forms of disease are induced, directly or indirectly,

by exposure to sewer gases. Several have recorded their opinion that typhoid fever is undoubtedly sometimes caused by inhalation of sewer air. In these very scientific days we are apt to look down with undue contempt on the views held by our forefathers, forgetful of the fact that some of them enjoyed wide experience and had been trained in the habit of close observation, which was all the more necessary before the advent of those aids to diagnosis which are now at the disposal of every doctor.

The conclusions of Laws and Andrewes have not gone uncontradicted. Even before their researches, Professor Frankland, in 1871, showed that although liquids flowing smoothly along gave off no solid particles to the air, yet the bursting of bubbles of gas in a liquid had a marked effect in the dissemination of solid particles. Several later observers, although confirming generally the experiments of Laws and Andrewes, as far as regards the types of bacteria found in the air of sewers, at any rate where the sewage was fresh and not putrescent, do not altogether agree with the conclusions deduced from those experiments.

The most remarkable set of recent experiments on the subject which have come to my knowledge are those of Major W. H. Horrocks, R.A.M.C.* It is in this paper that the new facts arise which I think should be carefully studied in any fresh consideration of the sewer ventilation question.

The results obtained by Major Horrocks will no doubt be tested by other experimenters, but I think that no one who closely studies the records of his experiments will fail to agree that they deserve serious consideration. I feel satisfied that further experience will only serve to confirm these conclusions. Their bearing on the question under discussion is sufficiently obvious.

The simplest plan of dealing with sewer ventilation is, if I may venture on an Irish bull, to have no ventilation at all. This is the solution of the problem, I suppose, in certain towns such as Bristol and Cheltenham. But in such a case it is obvious that a sudden inrush of sewage, or a sudden expansion of sewer air through the introduction of hot liquids into the sewer, or other cause, will lead to the breaking of the seals of the intercepting traps in the vicinity and the access of sewer air into the house drains. The gases will come out at the low vent, and if the drains are at all defective, there is a great tendency for the gases to penetrate into the house itself. The difference of temperature between the interior of the

* Recorded in a paper read before the Royal Society, and printed in the Journal of The Royal Sanitary Institute for May, 1907, Vol. XXVIII., page 176, under the title, "Experiments made to determine the conditions under which 'specific' bacteria derived from sewage may be present in the Air of Ventilating Pipes, Drains, Inspection Chambers, and Sewers."

house and outside is sufficient to draw any foul gases in the adjoining subsoil into the building.

Of actual methods of attempting to ventilate sewers, the easiest and cheapest is to provide surface-level openings in connection, either directly or indirectly, with the manholes. Probably more sewers have been laid on this plan than on any other. But common sense and actual experience tell us that these surface openings are frequently offensive and cause a nuisance. Horrocks's experiments give us good reason for believing that, in addition, they are a danger to health, and that disease germs may be inhaled by persons passing over such openings. I am under the impression that various safeguards which have been proposed in connection with this method, such as filtering the escaping air by means of charcoal or some chemical, are rarely used now. The charcoal method is certainly ineffective as soon as the charcoal becomes wet; also, all these methods must create obstacles to the free passage of air, besides being costly and troublesome to maintain in anything like proper working order.

The next method of sewer ventilation which I shall refer to is dependent upon the abolition of the intercepting trap. This is a method which has found much favour of late, especially among engineers, whereas most medical officers of health I believe have been opposed to it. At first sight it appears an excellent solution of the difficulty, as, by having tall ventilating shafts on each house drainage system, you have the sewers connected to an immense number of ventilating shafts, each of small area, but combined giving an ample area of openings for the extraction of foul and the admission of fresh air. The local authorities have nothing to pay in the shape of way-leaves, no trouble to find suitable positions, no expense of upkeep, no complaints of smells from surface-level ventilators. Some of the soil-pipe ventilators no doubt act as inlets, and others as outlets, and most of them act sometimes in one direction and sometimes in the other. The total result is very satisfactory, however, from the point of view which looks only at the constitution of the sewer air. Probably under such a system the air in the sewers would never smell very foul. But if Horrocks's experiments prove anything, they prove the value of the intercepting trap in preventing the air of sewers from contaminating the house drains, and in cutting off the drains of one house from its neighbour so that the presence of typhoid excreta in the drains of one house will not mean the possible and even the probable passage of the typhoid bacillus into the drain air of the adjoining and other property. In such a case a comparatively minute leak in the drainage system close to the house might be a very great danger. It is

precisely the joints close to the house which, even if sound at first, are apt to become defective owing to a slight settlement of the foundations. I think there is very good reason for the almost universal desire among tenants to know that their drains are effectually cut off from all direct aërial connection with those of their neighbours and from the sewer. I am therefore of opinion that this method, although very tempting on account of its simplicity and cheapness, is dangerous, and cannot be recommended.

In some places where they have not gone so far as to abolish intercepting traps, ventilating pipes of light iron, such as is often employed for soil-pipes, and of 4-inch or 6-inch diameter, are employed, connected directly to the sewers, but running up house walls. These, of course, if carried well above the roof, are safe so long as all the joints are air-tight, both those above as well as those underground. But any settling of the house walls leads to a defective joint at the most important place, namely, the connection of the iron pipe to the earthenware drain. Any leak in this situation allows sewer gas to enter the house. The fear of this creates great difficulty now-a-days in getting permission to fix these pipes to a house side: personally I should have much objection to living in a house to which such a sewer ventilator was attached. There is less objection to affixing such pipes to the walls of buildings such as stables or warehouses. I have seen them attached to telephone or telegraph posts, but I should imagine the effect of strong winds would rapidly cause a defective joint at the foot of the pipe.

Attempts have been made in some places to secure effective ventilation by connecting large diameter pipes to mill chimneys or furnaces to obtain a strong extracting effect. Unfortunately it is found that the suction may be so strong as to unseal the intercepting traps in the immediate neighbourhood of the ventilator, whilst the effect is felt only very slightly at a little distance. Shone's system of mechanical ventilation carries the principle of mechanical extraction very much further, and is undoubtedly very ingenious, with its scientifically arranged size of air inlet proportioned to the distance from the source of extractive power. It seems to me, however, that the cost both of installation and of working must necessarily be very high, whilst any accidental or unauthorised inlets would be liable to upset the working of the whole system.

Some forms of ventilating lamps in the shape of small iron independent columns give a certain extracting effect, and are at the same time supposed to burn up and destroy organic matter and to kill any germs present. I have no doubt that this does occur to some extent, but we

have as yet no satisfactory evidence that this disinfection of sewer air is so complete as to render these lamps safe to be employed so close to the windows of dwelling houses as would sometimes be necessary. Besides, with a sufficient number of these lamps to give efficient ventilation, the cost of the gas consumed would amount in the course of the year to a very considerable item.

To my mind, the only method of sewer ventilation which can be safely recommended at present is by means of independent ventilating columns of iron or steel, tall enough to carry all dangerous gases well above all dwelling houses, placed as near the sewers as possible, and with the smallest possible number of bends. Where lighter but still gastight shafts can be erected against buildings, not used for constant occupation by human beings, these might also be used. It is no use labelling one as inlet and another as outlet, because each column will act sometimes in one way and sometimes in the other. I believe, however, that natural agencies would keep up air currents; such as the wind blowing over the top of the shafts and the effect of the sun's heat, which often, I think, acts very strongly in the case of an iron shaft. Such a system gives us at any rate an outlet for sewer gases, and prevents the forcing of house traps. I do not believe that it would give a pure air in our sewers under all conditions, such as a state of little wind and a close approximation of temperature outside and inside the sewers, but under ordinary circumstances it will keep the air sufficiently safe to allow of the workmen entering the sewers when necessary. This, I think, is all we can expect, and would be very much better than the state of things now existing in many places, in which a policy has grown up of closing all the surface ventilators as complaints occur, until at last the sewers are left unventilated, giving rise to occasional forcing of traps and the consequent dangers.

To refer for a moment to a subject not exactly within the scope of my paper I would say that Horrocks's experiments have confirmed a conclusion which has been forcing itself on my mind for several years past, and that is that the low ventilator, as usually fixed, is a danger and will have to be abandoned. Sometimes these are fixed in the front garden walls of houses: the flushing of a w.c. in a house where there is a case of typhoid may easily convey the germ to a casual passer-by. Similarly with sewer gas escaping through the forcing of a trap. Another form of danger arises from the increasing frequency of fixing an intercepting chamber instead of merely a trap. Builders, unless they are strictly looked after, often neglect to cement the inside of these chambers. The

result is practically to have a leaky drain, as the ordinary brick walls of these manholes are pervious to drain or sewer gas. Similarly the manhole cover is often left unsealed by Russian tallow. What is the use of being so careful to have airtight cement joints to the drain, buried many feet under ground, and yet to leave the manhole defective? Another item requires careful attention. The stopper of the rodding arm of the disconnecting trap in the chamber. All who have had much experience will agree that it is the exception rather than the rule for a builder's workman to fasten in the stopper with Russian tallow. Consequently, when examining such a manhole one finds the stopper loose and practically useless, or out altogether, thus giving free access to sewer air. Or it may be that a mysterious block causes an investigation and the stopper is found to be the delinquent, having been carried through the trap and blocking the drain on the sewer side of the trap. I think some form of stopper arranged to be securely fastened should be compulsory, and I hope that some inventive genius will soon produce an intercepting trap with a patent stopper, easily fixed, perfectly airtight, and immovable under ordinary circumstances, yet easily removed from the manhole top in case of a block, and not substantially more expensive than the ordinary type.

JOHN S. BRODIE, M.Inst.C.E.

DO sewers require ventilating at all? Probably, that infallible authority, the Man-in-the-Street, thinks they don't; that sewer smells are largely, if not entirely, imaginary; that ventilation is only a fad of medical and other sanitary enthusiasts; and that both himself, and his immediate predecessors never suffered any inconvenience from sewer air or sewer gas.

But even usually well-informed people are to be found who are convinced that unpleasantly smelling air or gas issuing from a sewer grating is really not dangerous or injurious to health. This party has, until recently, had much scientific support, from the investigations of such scientists as Dr. Parry Laws, Dr. Andrewes, and others in this country, and of Professors Kirchner and Sokoya, to name only two, on the continent. These learned men have given us their assurance that there is no proof of there being any connection between sewer gas and the spread of epidemic diseases.

Yet another group of people are to be found who don't deny that gases of a dangerous nature are actually to be found in sewers, but who sincerely

believe in the bottling-up theory, presumably on the old principle of out of sight (or smell) out of mind (or danger). These latter advocate the closing up of all openings into or out of the sewers except the connections thereto made by the drains to houses and other premises, and then only by means of air-tight water-sealed traps.

Now, what are the simple facts on this subject?

1st. Every year cases are reported in the public prints of workmen, whose duty it is to see to the efficient working of sewers, being poisoned, sometimes fatally, by the escaping gas from the sewers: and for one case reported it is well known that at least twenty are never publicly made known, when the results are not fatal. Surely, the proof of the quality of the sewer air is in the breathing!

2nd. Why are those who are responsible for the health of the districts committed to their care, namely, the Medical Officers of Health, so anxious that the house (the unit of each district) shall be as effectually cut off from the sewer, by means of the intercepting trap, or some equally efficacious arrangement, as the ordinary householder is to keep out burglars? Because they are well aware of the dangers to health which would follow from a free communication between the sewers and the house drains.

3rd. We now have, as the result of recent bacteriological investigations by Dr. S. Rideal,* Major Horrocks,† M.D., F.R.S., and others, very good proof that sewer air is "a nuisance and injurious to health."

If, then, we are all of one mind that sewers should be ventilated, the only question (a fairly large one) that remains is, by what method or methods can this object be best accomplished? Very many attempts have been made in the past, by more or less ingenious contrivances, to ventilate sewers. Most of the methods or systems tried have been found wanting, and are now consigned to oblivion.

Generally, it may be said that all efforts to ventilate sewers can be classified into three divisions, Natural Ventilation, Artificial Ventilation, Deodorization.

The Author will content himself with a description of one or more of the most important types only of each of the above methods.

Natural Ventilation.

The natural ventilation of sewers may be said to range from the almost total absence of intentional ventilation of any kind, as at Bristol, to a

* *Journ. R. San. I.*, Vol. XXV., p. 596. † *Journ. R. San. I.*, Vol. XXVIII., p. 176.

well thought-out system of high shaft inlet and outlet ventilators, such as has been so thoroughly worked out and is now being adopted at Leicester.

The beginnings of sewer ventilation were doubtless the untrapped house drains and gully connections of the middle of the last century.

Then followed the regularly made shaft connecting the surface of the street with the underlying sewer, generally called a ventilating shaft, but, when of sufficient size to admit the passage down it of a workman, known as a manhole, with open gratings, so as to allow sewer air to escape, or fresh air to enter, it mattered little which.

Then a distinct epoch was marked in the history of sanitary engineering by two important events in 1870 and 1871. One was the invention of the intercepting trap, by Mr. W. P. Buchan, of Glasgow; the other was the succession of the late Sir Robert Rawlinson as Chief Engineering Adviser to the Local Government Board. It may be truly said that the practical sanitary progress made during the last forty years is due to the pioneer work of Sir Robert Rawlinson, who so well and truly laid the foundations, both broad and deep, upon which all the good sanitary work has been built.

Under Rawlinson's sympathetic guidance, Buchan's, or what is now known as the intercepting, trap, was fixed on nearly all house drains, so that no aërial connection between the separate house drains and the common sewer should be possible. He also recommended "that wherever a trap is placed on a sewer or drain, there should also be means for sewer and drain ventilation provided to relieve such trap." Unfortunately the Local Government Board, in their By-laws, did not insist on a ventilator being fixed on the sewer side of the trap, with the result that, while house drains were provided with high shaft ventilation, sewers were not, but relied entirely on the surface gratings. It is easy to see, therefore, that with the general introduction of the intercepting trap, and the consequent shutting off of sewer ventilation by means of the house drains, the conditions of the sewers as regards the emanation of foul smells from them gradually became worse, until about the year 1880 onwards, the question became pressing. In many towns the sewer gratings were gradually closed as they were complained of; in other towns the surface gratings were allowed to remain open, but high shafts against buildings were connected to the sewers; in still other cases a combination of both methods was tried, until by the able experiments and tests made by Mr. Mawbey at Leicester, it is now generally admitted that good sewer ventilation is possible by high ventilating shafts alone, without surface gratings.

From inquiries recently made, the author finds that in regard to

natural sewer ventilation in English towns, the present practice is approximately as follows: 81 per cent. have adopted upright shafts in addition to surface gratings; 14 per cent. are now substituting high ventilating shafts for surface ventilators, which are being closed; 5 per cent. have surface ventilators only.

From the above, we may conclude that sewer ventilation at the surface of carriage ways is now rapidly going out of use, as it should do.

The upright ventilating shafts, whether placed against buildings, or as special columns placed on the footpaths, should be of sufficient height to be from 6 to 10 feet above the ridges of adjacent buildings, of a proportionate sectional area to the sectional area and capacity of the sewer to be ventilated, and from 150 to 200 yards apart.

The first cost of a high shaft system of natural sewer ventilation averages about £120 per mile of sewer ventilated, and the annual cost, including ten per cent. allowance for depreciation, averages about £18 per mile of sewer ventilated.

Artificial Sewer Ventilation.

Two systems of artificially-produced air-currents in sewers now hold the field, and both have good promise of ultimate success.

One is the Webb System, a method of extracting foul air from sewers, and at the same time cremating it by heat, invented and patented by Mr. Joseph E. Webb.

In appearance, the Webb Sewer Ventilator closely resembles an ordinary incandescent street lighting gas lamp, with a cluster of three incandescent gas-burners. By a system of heat reflectors, the sewer air or gas is drawn from the sewer through an air-tight copper tube fitted inside the lamp column, into the narrow neck of the lamp, about $3\frac{1}{4}$ inches in diameter, through which the sewer air is made to pass at a temperature of about 550°F., generated by the three incandescent coal gas burners in the lamp.

By the Webb method it is claimed that the following are secured:—

(*a*) The convection of rays of light and heat by reflectors, thereby producing convex rays.

(*b*) The complete destruction of organic matter in the sewer air by focussing heat-rays on it.

(*c*) The conservation of heat by air or pneumatic isolation.

(*d*) That there is no possibility of organic matter or foul gases passing through the apparatus without being destroyed, from the fact that it does not rely on actual contact with heated surface, but is forced through superheated space.

The cost of installing the Webb system is about £58 per mile of average size of sewer ventilated, and the annual cost, including 10 per cent. depreciation, gas, attendance, &c., is about £33 per mile of sewer ventilated.

The other artificial sewer ventilator is that recently introduced by the well-known sanitary engineers, Messrs. Shone & Ault.

This system is known as the hydro-mechanical system, and is the only method by which the double object of ventilating both the house drains and the common sewers is accomplished by one operation.

The system is based on the principles of coal mine ventilation. The foul air is exhausted from the sewers by means of a fan, driven electrically or otherwise, and the admission of fresh air is rigidly controlled at all openings leading into the sewers. By means of these controllers or regulators, which are adjustable and fixed in the intercepting trap chambers of the house drains, and at other openings where necessary, only sufficient fresh air is drawn into the sewers to keep them wholesome and free from danger, and the amount of vacuum caused by the fan is so graduated as to avoid any possibility of destroying the water-seals in the house drain intercepting traps.

The foul air, when extracted by the fan from the sewers and house drains, is forced through a deodorizing medium, and is then discharged into the open air by means of a high upright pipe or column, of adequate sectional area. The system has been tried, on a limited scale, at Leicester, and has been found to give satisfactory results, at a fairly moderate cost.

It must, of course, be borne in mind that by the hydro-mechanical system, not only is the sewer ventilated, but the house drains also, and allowing for the saving to be effected by doing away with the present inlet and outlet ventilators under the present house drain ventilating system, the cost of Messrs. Shone and Ault's system will probably compare favourably with that of the present system of house drain ventilation *plus* that of any other efficient sewer ventilating system.

In the author's opinion, this system is well worth being tried in new districts, when the first cost would not be great, whereas its adoption on existing sewerage systems, while not impossible, would necessarily involve greater cost.

Exclusive of the ventilation of the house drains, and providing for sewer ventilation only, the cost of installing the hydro-mechanical system is, on the average, about £150 per mile of sewer ventilated; and the cost of working and maintenance, including 10 per cent. depreciation, is on the average about £30 per annum.

Deodorization of Sewer Gases.

Many devices have been tried to render harmless the foul odours emanating from sewer ventilating openings.

As far back as 1862, Sir Robert Rawlinson advocated the use of charcoal filters, and this idea was taken up and thoroughly tried by Mr. Baldwin Latham in 1879 and onwards, but along with many others has now been discarded as being worse than useless.

The apparatus most in use at present as a sewer-air deodorizer, is that of the Reeves Chemical Sanitation Company.

This apparatus consists essentially of two chemical ware vessels, placed in a recess formed in a sewer manhole shaft. One of these vessels contains a patented chemical mixture called Reevezone, and the other contains strong sulphuric acid. These chemicals are caused to mix continuously, the result of their mutual reaction being the formation of sulphurous acid gas, oxygen gas, permanganic acid, and soda sulphate. The gases purify the foul air with which they come in contact, whilst the oxidising solution falls into the sewer and is said to have a beneficial effect on the sewage.

The Reeves apparatus has been extensively tried at Edinburgh, Southport, and other places, and is now understood to be under trial in a modified form on some of the large main sewers of London.

The cost of the installation of the Reeves system is about £100 per mile of sewer ventilated, and the annual cost of maintenance, including 10 per cent. depreciation, about £44 per mile of sewer ventilated.

Summary of the Approximate Cost of the above methods of Sewer Ventilation.

Name of System	First cost per mile of sewer ventilated.	Annual cost per mile of sewer ventilated
	£	£
High Shaft Ventilation	120	18
Webb's System	58	33
Shone and Ault's Hydro-mechanical System	150	30
Reeves' Chemical System	100	44

It is submitted, from the facts and figures given, that the satisfactory ventilation of common sewers is practicable, at a cost which is not unreasonable; and also, that no public sanitary authority is now justified in neglecting its responsibilities in this connection under the Public Health Act, 1875, which plainly states (Sec. 19) that "Every local authority shall cause the sewers belonging to them to be constructed

covered, *ventilated*, and kept so as not to be a nuisance and injurious to health."

The Intercepting Trap.

It will be gathered, from what has gone before, that the author is not among those Borough Surveyors who have recently taken to agitating for the abolition of the intercepting trap. Not its abolition, but its proper construction as regards size, shape, materials, and proper fixing, is required as regards that useful sanitary appliance.

At bottom, the objections to the trap appear to be as follows:—

1. That it is a hindrance to the proper ventilation of the common sewer. Surely, the exit of foul air from the common sewer, *via the private house drains*, to the open air, only needs to be clearly stated to carry its own condemnation, for reasons which must be obvious to everyone.
2. That it is of itself a small cesspool, liable to produce insanitary conditions. This objection simply begs the question, as, if the trap is laid with reasonable care and intelligence, under normal usage no such insanitary conditions can arise.
3. That it is constantly stopping up and causing trouble, expense, and danger to the household. The author, from the experience of a life-time, can bear testimony to the fact that in every stoppage in an intercepting trap coming under his observation, one of three reasons have been found as the cause of stoppage:—(*a*) An imperfect trap, having practically no gradient, or drop, in itself. (*b*) A good trap, improperly laid, with the joints badly made. (*c*) A trap of proper construction and well laid, but such utensils as worn-out blacking brushes, and similar articles, found in it, which should have been put in the house-refuse bin, and not sent down the house drain.
4. That the intercepting trap causes a considerable diminution of the limited fall available in many cases for the house drain. The proper amount of fall, or drop, for any house drain interceptor is certainly not more than *two inches*, and if the gradient of the house drain is cut so fine as not to allow that, it ought *not* to be.

The author is of opinion that, until the present method of water-carried sewage is superseded by some greatly improved method, which at present is certainly not within sight, the intercepting trap is a sanitary necessity, and cannot with safety be dispensed with.

Dr. Gilbert J. Fowler (Manchester) said that he had had occasion not infrequently to go down sewers, and recently he had taken a certain part in experiments on the ventilation of sewers, which had been carried out in Manchester. Opinion on the subject for discussion was evidently still divided. On the one hand they had a large body of experience showing that the health of sewermen was, on the whole, good; and the researches of Parry-Laws and Andrews had been confirmed by Miguel in Paris and by Professor Delépine in Manchester, who had also been unable to find the presence of the specific organisms of sewage in sewer air. One of the sights of Paris was a journey through the sewers. On the other hand, the opinion of those who believed sewage gas to be dangerous to health had received confirmation from the researches of Major Horrocks. It was necessary, therefore, carefully to consider the conditions leading to the production of sewage gas. In the first place, the evolution of sewage gas was due to *accumulations* of foul matter in the sewer. Shortly after joining the Corporation's service in Manchester he had occasion to investigate the composition of gas which had been set alight by a workman's candle, and which had caused a serious accident. He had found that the gas consisted mainly of marsh gas and hydrogen, and was evidently evolved through the decomposition of sewage in the dead end of an old sewer, which had virtually become a septic tank. These deposits, also, were likely to evolve sulphuretted hydrogen, which, in a confined space, was more highly poisonous than many people were aware, as had been shown by more than one fatal accident in Manchester. The danger of evolution of such gas was greatly increased by the presence of certain trade effluents (*e.g.*, strong acids), and fairly drastic powers had been obtained in Manchester to prohibit the discharge of such effluents into the sewers. It was very important, however, to prevent as far as possible the formation of deposit in sewers, by taking care that the sewers were constructed of good material and with adequate fall. This was more easily done in the case of newly-designed systems than where the main system had been laid down many years ago. In Frankfort and in the suburbs of Berlin he had been down sewers where the material used was either glazed brick or very high quality smooth red brick; and also the manner of construction was such as was seldom attempted in this country. The next factor in the evolution of sewage gas was *temperature*. In the course of his work in India he was much struck by the rapidity with which sewage decomposed in tropical temperatures; in consequence of this, special precautions were taken (*e.g.*, in Bombay) before entering sewers. It occurred to him that the high temperature obtaining in Gibraltar (where, he believed, Major Horrocks's experiments were carried out) might partly account for the extraordinary results obtained. A third factor to be considered was the *velocity of flow* of sewage and air. It could be shown by anemometer tests in the sewer that the velocity of air was greatest immediately above the surface of the sewage. In the comparatively small pipes used by

Major Horrocks the velocity of the air currents would be much greater than in ordinary sewers. Bearing in mind the above factors in the problem, the question arose what remedies should be adopted. Experiments had been carried out in Manchester, and had been published in a report to the City Council, to test the efficiency of various methods of artificial ventilation. The Shone system had been found to work well, but necessitated air-tight sewers, a condition which it was not always easy to fulfil. The Webb lamp was successful in preventing nuisance and in destroying any organisms in the escaping gas, but had no great power of ventilation. The general conclusions seemed to be that every care should be taken in the design and construction of sewers to prevent accumulation of sewage matter, and that ventilation should be effected by shafts placed in suitable positions.

Mr. C. Brownridge, (Birkenhead) congratulated Dr. Coutts and Mr. Brodie on the fair way in which they had stated their case. One was rather apt to look upon the subject as a sort of hardy annual, and he was afraid that the man-in-the-street might feel disposed to say "A plague on both your houses": for sanitarians seemed to be divided into two camps, one favouring open ventilation and surface gratings; and the other, upcast shafts. Generally he had found mechanical means of sewer ventilation a failure. He was now in a town where the intercepting trap was general, and where they were swinging over from the surface grating to the high shaft; but he thought they would have to look to the bacteriologist to guide them very much in the matter, and tell them from actual investigation when and under what conditions sewer air was dangerous; the engineer would then have something definite to work upon. The engineer had to see how he could meet the objections of the public, for the latter did not want to be confronted with the smell as they walked along the street. It was, however, not always the smell they experienced that was the real danger, and he thought bacteriologists might give a little assurance on that point. The smell that came from a sewer grating, although nauseous, was not necessarily one that would cause a serious illness, but that was no reason why it should be there. The question was, where were they going to take it: for if a pipe was conveying gases which were a danger to health, then it was equally dangerous, or nearly so, to discharge them above a bedroom window as it was to discharge on the road level. One could not dissociate the subject of sewer ventilation from the design and condition of the sewers and drains. If they did not have good sewers they knew that they were likely to have smells. If they had good sewers, they had very few smells: but how few took precautions to see that they had good sewers and drains. Special precautions were usually taken to insure that the joints of sewers and drains were made sound and watertight, but the equally important question as to whether

the pipe itself was reasonably watertight was often neglected. A bad joint was a danger. An imperfect pipe was likewise a source of danger by reason of the pollution of surrounding soil which resulted. Since November last he had tested under a 20-ft. head for one hour the pipes of thirteen makers, and he had found that only five makers' pipes would stand that test. Consequently, he could not help saying that in many towns there were being put in the ground pipes which were themselves setting up a condition of affairs which could not possibly conduce to the health of the community. In his opinion the intercepting trap was all right in its place if it were properly designed and laid. But the 2-gallon flush from water-closets, which was the limit permitted in many towns, was not sufficient to remove everything from the trap. Consequently, in considering the intercepting trap they ought not to neglect the question of the flush, and they ought to insist on one of not less than 3 gallons. One of the requirements of the model by-laws was that the air inlet should be down somewhere near the floor, and the outlet higher up on the side of the house; but engineers had proved that air currents in a sewer were altogether dependent on the outside wind, and that the outlets and inlets were often thereby reversed in action. If, in providing intercepting traps, they would in all cases put down two pipes of about equal height, it would remove most objections. In Birkenhead they would have no surface manholes in new streets, but upcast shafts at limited distances, these being mainly for the adjustment of the air pressure in the sewers, and not necessarily for ventilation.

Dr. E. Sergeant (Lancashire County Council) said he differed from Mr. Brownridge, who stated that smell need not be dangerous to health. It was a view that many people held, and he thought they were wrong, because he looked upon a smell as an indication of a danger to be avoided. He thought medical officers and engineers had been very much led astray by the researches of bacteriologists, who had done very useful work and on whom they relied very largely; at the same time he should not claim infallibility for bacteriologists. They had, for example, allowed them to assume that if one wanted good air one should go into a sewer. He maintained that was wrong. It did not accord with his own experience, his view being that although sewer gas might not produce a specific disease, it rendered the individual more susceptible to attacks in certain ways. He strongly adhered to the intercepting trap, which he thought should be looked upon as the first line of defence.

Mr. Cozard S. Pain (Liverpool) said he would suggest that the man instanced by Mr. Brodie was more likely to have been poisoned by gas which had not escaped from the sewers than by gas that was escaping. As a rule, sewermen were

healthy, and accidents arose chiefly from sudden rainstorms and in unventilated lengths from the absence of oxygen.

No doubt, from a municipal point of view, shafts placed up buildings were an ideal form of ventilation; as the generation of sewer gas was prevented, and the foul air was carried above the level of pedestrians and inmates of houses.

The objections were (*a*) interference with the rights of property and architectural appearance; (*b*) the practical impossibility of continually testing to be assured that no defects occurred in the vent pipes, even if they were perfect at first; (*c*) the serious risk of other defects which were almost certain to arise in course of time.

If sewer gas could be permanently destroyed by cremation, it would seem that the provision of exhaust fans at the lower ends of arterial sewers to take the foul air through incandescent tubes would answer, but the practical difficulty would probably be found in drawing foul air equally from all lateral branches, as there was always a tendency for such currents to follow in one direct course This being so, it would seem that the converse system would be more likely to be effective, as by it the volume of air forced into the sewers would tend to restrict the generation of sewer gas, and thus render the air at the outlets (which would be carried well above window openings) less vitiated, if not innocuous.

Whether sewer gas was capable of carrying disease or not, it was unpleasant and nauseating; hence, if for no other reason, intercepting traps were desirable. The objection to them as containing cesspools of liquid would not apply in the case of a 6-in. interceptor, where the contents were constantly changed before any ill effects could result; though in 9-in. or 12-in. interceptors (the use of which, in his opinion, was unnecessary) it might be otherwise. They hardly ever stopped up excepting from preventable causes, such as blown sand and the presence of domestic articles, which had no business in the drain.

The diminution in the gradient of the house drain in consequence of interceptors being fixed was really trivial. The use of ventilating shafts attached to house drains for sewer-ventilating purposes was undesirable, owing to the frequent imperfect obstruction of such drains, and from their liability to deteriorate from accident, age, and alterations.

If sewer air was unhealthy in the street, it obviously was more unhealthy if introduced into a house, and the risk of such introduction would be infinitely greater if the house drains were used for sewer ventilation.

It appeared to him that one of the advantages of intercepting traps lay in the exclusion of rats, which were always present in sewers, from the drains of the house.

As regarded the possibility of typhoid being contracted by germs carried in the air, without wishing to trespass upon medical ground he would draw attention to some extremely interesting evidence given in the recent Malvern case, at which he was present, where it was stated that typhoid bacilli were very

delicate and could not flourish under a temperature of 15° C., and that typhoid could not result unless the bacilli were swallowed.

Mr. A. J. Price (Lytham) said he did not think it was desirable to copy Bristol and have no ventilation, but it was questionable whether so great an amount of ventilation as recommended by many engineers was necessary; at previous meetings of the Institute he had stated that it was not ventilation they needed, but vent. From the experiments of Major Horrocks, quoted by Dr. Coutts, it was proved that bacteria were not ejected from the sewers in the absence of air currents, and that, he thought, showed that we could have too much ventilation. They were all agreed that surface ventilation was not only obsolete, but offensive and dangerous. At Lytham, whenever there was a complaint of a surface ventilator being offensive, he promptly blocked it up; and had for some time past erected tall shafts about 300 yards apart. The size of the shaft would depend upon the size of the sewer. In Lytham he found 6-in. shafts thirty feet high ample; but in Brighton they erected a number of tall shafts two feet in diameter.

He had a strong objection to putting sewer ventilators against houses, and had no sympathy with the views of those engineers who wished to compel householders to ventilate the sewers as well as the house drains up the side of their houses. The sewer ventilators should as far as possible be put in the public streets. With regard to mechanical ventilation he agreed with Dr. Coutts, rather than with Mr. Brodie's views on that point. He agreed there might be places where it would be desirable to use such a system as Shone's, but he did not think that it would work equally well in fine and wet weather. If the system was not automatic it was going to add greatly to the expense, and he could not see how it was going to work efficiently and economically during a heavy rainfall; for at such a time neither the sewers nor the house drains required any ventilation beyond vent. There was no smell in the sewers at that time, but in dry hot weather it was a very different matter.

With regard to the Webb lamp, he had had no experience; but his experience with other gas lamps showed they cost about £10 each per year for gas, and had been abandoned. They had been told that the Webb lamp had an outlet of 3¼ inches in diameter, and as that was only about one-fourth the area of a 6-in. shaft, and the lamps appeared to be spaced about a quarter of a mile apart, how were they going to efficiently ventilate the sewers on that system? There were certain positions where it might be advisable to cremate or disinfect the sewer gas, but he should not be prepared to adopt it as a general system; for he thought they could get better results with tall shafts at a much less cost. With 6-in. shafts placed 300 yards apart, costing £10 to £12 per shaft, they could ventilate a mile of sewers for £70, and the cost of painting the shafts and emptying the rust boxes should not cost £5 per year for each mile of sewer.

He was in agreement with Dr. Coutts and Mr. Brodie with regard to the

intercepting trap, but did not agree with those engineers who contended that it should be done away with. Gullies near to windows in front of houses were very apt to become unsealed in hot weather, and in these cases it would be distinctly objectionable if the intercepting trap were absent. Another point was that the Local Government Board would not sanction any by-laws unless provision was made in them for the fixing of an intercepting trap. Therefore, if they did not see that these traps were put in they ran a great risk if there was any infectious disease in the house. They all knew that when the doctor failed to diagnose the cause of the disease, he generally fell back on the drains; and if two or three medical men agreed that the outbreak was due to the absence of the trap, the local authority would be likely to be mulcted in heavy damages. Even if it were held by other doctors that the trap was the cause of the disease, the local authority had no legal responsibility: for they could only be held to be doing what they were legally bound to do. He was a strong believer in two shafts on a drain, both taken up to such a height that the gases from the drain were discharged safely; but had a strong objection to the mica flap on the air inlet, for he had seen it in practice lead to the unsealing of other traps.

MR. J. S. BRODIE, in reply, regretted that there were not any advocates of the abolition of the intercepting trap present. He thought they would all agree that the old surface ventilator was dead and gone, and that good ventilation could be achieved by means of shafts fixed along the kerbs or at the ends of houses, closing altogether gratings on the surface of streets. Mr. Mawbey, the borough engineer of Leicester, had established that, and they were all obliged to him for what he had done in showing that sewers could be ventilated by shafts only. Bacteriologists had been alluded to with a lack of that respect to which they were entitled, but a crumb of comfort for them was that borough engineers were waiting for a lead from them in regard to the point as to what were the constituents of sewer gas, and what was the proper way to deal with it. He had read with considerable interest the account of the researches of Major Horrocks, but he should like to have these corroborated, because the conditions in Gibraltar did not strike him as being the same as those in this country. For his own part he had very little doubt that they were correct. People said there was very little harm in a smell, but he for one said they must get rid of those smells from sewers. The question of sewer ventilation should no longer be left until complaints arose, and then tried to be remedied by more or less make-shift devices; but should be clearly and definitely provided for in connection with all new or extended systems of sewerage, and the cost included in the capital expenditure for the same.

DR. COUTTS, in replying to the discussion, expressed his disappointment that no one taking part in it had voiced the opinions of those who believed in

the abolition of the intercepting trap. He would have been interested in hearing the arguments which they might have brought forward, and particularly how they would have explained the results of Major Horrocks's experiments. Almost the only criticism of Major Horrocks's experiments came from Dr. Fowler, and he agreed with Dr. Fowler that as these experiments had been carried out in the warm climate of Gibraltar, it would be necessary for further experiments to be carried out in England to confirm them or otherwise, and to show how far the conclusions would apply in this colder climate.

He agreed with Dr. Sergeant that the smell of sewer air was not a negligible matter: if it was not always dangerous, it might be regarded as a danger-signal.

He did not agree that there was the same danger in drain air as in sewer air: as in sewer air there was the possibility of danger from the disease germs coming from all the infected drains entering a sewer, whereas the house-drain air could only be dangerous when disease was actually on the premises. It was therefore very desirable to cut off the house-drain from sewer air.

As to the question of the difference between the danger of drain or sewer ventilating openings at or near the ground level as compared with those reaching well above the house-tops, he thought the latter were far less dangerous, as owing to the greater air-movement the sewer or drain air quickly became very much diluted, and the germs blown away from the neighbourhood of the houses. As with other poisons, dose was of great importance in germ poisoning, and the more rapid and extensive the dilution the less the danger.

He was of much the same opinion as Mr. Price in regard to ventilating columns, that they need not be placed at very frequent intervals, and that their chief service was to act as safety valves by preventing the forcing of the intercepting traps on the house drains.

Mr. E. M. Bate (Frinton-on-Sea) wrote that, in discussing this subject, it might be of interest to state what had been done at Frinton-on-Sea to overcome the difficulties experienced in sewer ventilation.

Frinton-on-Sea was a purely residential town with wide roads and a good class of property. The air was exceptionally pure, and the least odours were easily detected.

The first portion of the main sewerage was carried out in 1897, with self-cleansing sewers and with ornamental iron ventilating shafts fixed on the Esplanade and several other parts of the town. These shafts were the outlets for sewer gas and the medium for ventilating the sewers. Since 1897 the sewerage had been extended, additional ventilating shafts had been fixed, and the length of the sewers was now upwards of twelve miles.

On account of the numerous complaints received by the Council as to the unpleasant odours from the ventilating shafts, he was instructed to prepare a report, with recommendations, on the ventilation of the sewers.

He submitted a report to the Council in June, 1906, recommending, after investigation, the Reeves new type ventilator for the Esplanade sewer. This ventilator, which had been tested constantly since it was fixed, did the work claimed for it. Caink's ventilator has been used successfully as a sewer safety valve.

In addition, manholes with apparatus for ventilating the tidal sewers and the low-lying portion of the town had been constructed. The outfall sewer was charged with fresh air from the apparatus chamber at every tide, and the tidal action was used as a motive power for ventilating the sewers in the adjoining district. The gases which were previously forced backward and forward twice each day into the town were now, by this scheme, successfully dealt with at every tide.

With the results obtained at Frinton-on-Sea, he did not think the subject of the abolition of the intercepting trap with the view of ventilating sewers on private property needed discussing.

RIVERS POLLUTION.

WITH SPECIAL REFERENCE TO THE BOARD PROPOSED BY THE ROYAL COMMISSION.

(Discussion continued.)

Paper by HERBERT T. SCOBLE,
(MEMBER.)

Read at Sessional Meeting, London, April 8th, 1908.

IN continuing the discussion opened by Sir William Ramsay on the above subject, it will be well in the first place to refer to one or two of the remarks made on 12th February last. The establishment of watershed authorities having control over pollution, water supply, navigation, fishing interests, and, especially, charged with the prevention of floods, has been so authoritatively recommended by Commissions and Committees that it is somewhat surprising to hear Dr. Barwise stigmatise the creation of an independent authority to deal with the first two only of these matters (pollution and water supply) as "a fantastic and chimerical idea."

It is interesting to learn from the same speaker that the Derbyshire County Council has "already provided the machinery for enforcing the Rivers Pollution Prevention Acts, and it would be very unfair to take those powers away from them." The Duke of Sutherland wrote to the Lord-Lieutenant of Staffordshire (Earl of Dartmouth), on 13th July, 1905: "I am advised that, with the river in its present state, it is unsafe for my family to reside there, so that, summing up the whole position to-day, I am forced to the conclusion that Trentham is ruined as a residence, and that I have no choice but to close the house, and give up the upkeep of the gardens, etc." The Hall was offered to the Staffordshire County Council, and the naïve comment appeared in the *Standard* of December 12th, 1905, "The cleansing of the river Trent, the pollution of which caused the Duke to leave Trentham Hall, must now be taken in hand in earnest." In the same district one sufferer, the principal of a large public institution, writing on the subject, stated that "during the

recent spell of hot weather the stench has been most obnoxious and unbearable. Between two and four in the early morning the foul taste in our mouths wakens both officers and inmates, and many of us get up and rinse out our mouths, close all windows, and sprinkle the room with disinfectant."* It would appear that the machinery provided needs a little oiling.

Professor Kenwood said, "He could wish that the Boards when appointed could have an amended Rivers Pollution Prevention Act to administer, for there could be little doubt that the existing Acts were very unsatisfactory." This is most important, and the following are the chief items to be included in the powers given to Rivers Boards:—Power at all times of entry, of inspection, and of sampling; prevention or regulation of the sludging of mill-dams, etc.; simplified methods of proceeding against defaulters; and last, but not least, the supervision of one or more complete watersheds. The Mersey and Irwell and the West Riding Boards found the Rivers Pollution Prevention Act inadequate, and obtained, shortly after formation, further powers under special Acts.

The recent Royal Commission on Salmon Fisheries in their Report, dated 10th July, 1902, say on page 12:—"There are three great subjects, for all of which, in our opinion, the Watershed is the proper administrative area, *i.e.*, Pollution, Water Supplies, and Fisheries." The Vice-Regal Commission on Arterial Drainage (Ireland), 1905, reported early in 1907: Sir Alexander Binnie was chairman. In their opinion the larger catchment basins should be made into conservancy board areas. Drainage is, of course, the chief consideration in Ireland. The county councils: the benefited lands; and the other interests, *viz.*, navigation, fisheries, water power, and towns, should all be represented. The county councils to nominate not less than two-thirds of the members; and the other interests to be represented, so that they may have early opportunity of stating their views on matters of policy and of making their wishes and objections known.

If I might venture to draw up a list of subjects within the scope of the activity of river boards, I would group them as follows:—

A. Prevention of pollution: *(a)* Disposal of (1) sewage (2) storm-water, (3) liquid trade-wastes, (4) waste waters from mines, and (5) mud from mill-ponds, etc.; *(b)* Storage and transport of (1) manure, gas-lime, etc., and (2) refuse, ashes, cinders, etc.

B. Water supply: *(a)* Supplies to outside areas; *(b)* for (1) domestic

Standard, 27th July, 1905.

purposes, (2) manufactories, (3) irrigation, and (4) grazing stock: (c) use for power.

C. Fishing interests, etc: Protection of (1) fish, (2) shell-fish, and (3) watercress, etc.

D. Prevention of floods. E. Navigation. F. Public health, boating, bathing, etc. G. Settlement of disputes, with appeal to the central authority as a final tribunal.

It must be apparent that the interests in any large catchment basin are necessarily antagonistic, and there can be no doubt that the proper adjustment of conflicting rights is not always attained in the Courts. Too often the consideration of expense deters those who are suffering unquestionable wrong from moving in the matter. Were rivers boards established it might be possible for them to hit the happy mean between opposing claimants; local interests would be practically eliminated if large areas were taken, and therefore, in all probability, influential persons appointed on the boards.

Mr. Raikes on the last occasion questioned the necessity of many boards, and suggested the number six for England and Wales. I have prepared a sketch map and a schedule of the catchment-basins of the principal rivers in England and Wales, and would call attention to the very large areas to be taken, even if the higher number fifteen mentioned by Sir William Ramsay be adopted. I also append a list of County and County Borough Councils. The grouping of areas will depend very largely on local considerations; where there are many purification works (sewage or manufacturing) the district will naturally be smaller than where the population and liquid trade wastes are less. Some convenient centre must be selected in each case for offices.

Brief reference may be made to the existing Rivers Boards.

I.—*Thames Conservancy.* *Area*—nearly 4,000 square miles.

Members—38: 31 appointed and 7 elected.

Appointed—Admiralty 2, Board of Trade 2, Metropolitan Water Board 1, Trinity House 2, Berkshire 1, Buckinghamshire 1, Common Council (City) 6, Essex 1, Gloucestershire and Wiltshire 1, Hertfordshire 1, Kent 1, London County Council 6, Middlesex 1, Oxford City 1, Oxfordshire 1, Reading 1, Surrey 1, and West Ham 1.

Elected—Shipowners 3, owners of sailing barges, lighters, and steam tugs, 2, dock owners 1, and wharfingers 1.

(Note.—An area of 158 square miles within the catchment basin, being portions of Bedfordshire, Northamptonshire, Sussex, Warwickshire,

and Worcestershire, is not included, but in the opinion of the Conservators should be supervised and represented.)

II.—*Lee Conservancy.* *Area*—about 600 square miles.

Members—15: 10 appointed and 5 elected.

Appointed—Metropolitan Water Board 2, Bedfordshire 1, Common Council (City) 1, Essex 1, Hertfordshire 1, London County Council 2, Middlesex 1, and West Ham 1.

Elected—Hertfordshire Corporations, etc., 1, Essex do. 1, Middlesex do. 1, Hackney, Limehouse, and Poplar 1, and barge owners 1.

III.—*Ribble Joint Committee.* *Area*—550 square miles.

Members—16 elected: Lancashire 9, Blackburn 2, Burnley 2, Preston 2, and Wigan 1.

IV.—*Mersey and Irwell Joint Committee.* *Area*—652 square miles.

Members—24 elected: Cheshire 3, Lancashire 8, Bolton 1, Bury 1, Manchester 6, Oldham 1, Rochdale 1, Salford 2, and Stockport 1.

V.—*West Riding of Yorkshire Rivers Board.* *Area*—2,768 sq. miles.

Members—30 elected: West Riding 17, Bradford 3, Halifax 1, Hud-Huddersfield 1, Leeds 4, Rotherham 1, and Sheffield 3.

Sir William Ramsay dealt so fully with the functions of the central authority that it would have been mere reiteration to traverse the same ground, and I have, therefore, occupied myself with the subordinate authorities, Rivers, Watershed, or Conservancy Boards.

By way of summary I submit the following points:—

1. Gross pollution of many rivers continues and increases because it is not the duty of any department or authority to enforce the laws to the contrary, passed over thirty years ago.

2. Joint committees, as authorised in the Local Government Act of 1888, have only been established in three districts: an example of the futility of permissive legislation.

3. River Boards having the control of one or more watersheds are needed in the best interests of all concerned.

4. An expert central authority is required, first to constitute and then to look after the River Boards; to deal with the larger questions of policy; to act as a final tribunal for all matters in dispute; to collect information; to conduct or to supervise experiments; and to issue reports.

I have read the evidence given in the published reports of the Royal Commission on Sewage Disposal and have been favoured from time to

time with copies of the reports of the existing river boards, and have no hesitation in affirming that they have accomplished much good work which, most likely, would have been left undone had they not been in existence. I strongly approve of the recommendation in favour of the formation of such boards for England and Wales, together with the creation of a central authority. In so far, therefore, as the Bill about to be introduced by Mr. John Burns, President of the Local Government Board, embodies the principles detailed I have to ask for your support.

Since writing the above, the Port of London Bill has been published, in which an alteration is proposed in the area under, and the constitution of, the Thames Conservancy. The eastward limit to be Teddington; and the Conservators, 17 in number, to be appointed as follows:—

Board of Trade 1, Port Authority 1, Metropolitan Water Board 1, London County Council 1, Gloucestershire and Wiltshire 1, Oxfordshire 1, Berkshire 1, Buckinghamshire 1, Surrey 1, Middlesex 1, Oxford City 1, Reading 1, Kingston-upon-Thames 1, Windsor 1, Henley-upon-Thames 1, Maidenhead 1, and Abingdon and Wallingford 1.

I take it that, even if a change be made at the Local Government Board the promised Rivers Bill will be introduced.

County and County Borough Councils of England and Wales.

Anglesey	A.	Devon	Dn.
Bedford	Bd.	Devonport.	
Berks	Bs.	Exeter.	
Reading.		Plymouth.	
Brecknock	Bk.	Dorset	Dt.
Buckingham	Bm.	Durham	Dm.
Cambridge.		Gateshead.	
Cambridge	CC.	South Shields.	
Isle of Ely	CE.	Sunderland.	
Cardigan	Cg.	West Hartlepool.	
Carmarthen	Cm.	Essex	E.
Carnarvon	Cv.	West Ham.	
Cheshire	Ch.	Flint	F.
Birkenhead.		Glamorgan	Gm.
Chester.		Cardiff.	
Stockport.		Merthyr Tydfil.	
Cornwall	Cl.	Swansea.	
Cumberland	Cd.	Gloucester	Gs.
Denbigh	Db.	Bristol.	
Derby	Dy.	Gloucester.	
Derby.			

Hampshire.	
Southampton	HS.
Bournemouth.	
Portsmouth.	
Southampton.	
Isle of Wight	HW.
Hereford	Hf.
Hertford	Ht.
Huntingdon	Hn.
Kent	K.
Canterbury.	
Lancashire	Ls.
Barrow.	
Blackburn.	
Blackpool.	
Bolton.	
Bootle.	
Burnley.	
Bury.	
Liverpool.	
Manchester.	
Oldham.	
Preston.	
Rochdale.	
St. Helen's.	
Salford.	
Southport.	
Warrington.	
Wigan.	
Leicester	Lc.
Leicester.	
Lincoln.	
Holland	LH.
Kesteven	LK.
Lincoln.	
Lindsey	LL.
Grimsby.	
London	Ln.
Merioneth	Mr.
Middlesex	Mx.
Monmouth	Mm.
Newport.	
Montgomery	Mg.
Norfolk	Nk.
Great Yarmouth.	
Norwich.	
Northampton.	
Northampton	NN.
Northampton.	
Soke of Peterboro	NP.
Northumberland	Nd.
Newcastle-upon-Tyne.	
Tynemouth.	
Nottingham	Nt.
Nottingham.	
Oxford	O.
Oxford.	
Pembroke	P.
Radnor	Rn.
Rutland	Rd.
Shropshire	Sp.
Somerset	Ss.
Bath.	
Stafford	Sf.
Burton-upon-Trent.	
Hanley.	
Smethwick.	
Walsall.	
West Bromwich.	
Wolverhampton.	
Suffolk.	
East	SkE.
Ipswich.	
West	SkW.
Surrey	Sy.
Croydon.	
Sussex.	
East	SxE.
Brighton.	
Hastings.	
West	SxW.
Warwick	Wk.
Birmingham.	
Coventry.	
Westmoreland	Wd.
Wiltshire	Wt.
Worcester	Wr.
Dudley.	
Worcester.	
Yorkshire.	
East Riding	YER.
Kingston-upon-Hull.	
York.	
North Riding	YNR.
Middlesbrough.	
West Riding	YWR.
Bradford.	
Halifax.	
Huddersfield.	
Leeds.	
Rotherham.	
Sheffield.	

Catchment Basins (in square miles) of the Principal Rivers in England and Wales, N.E. to N.W.

Till (to the Tweed)	231
Tyne	1,130
Wear	456
Tees	708
Derwent (Y., N. and E.R.)	794
Ouse (Y., N. and W.R.)	1,842
Swale.	
Ure.	
Nidd.	
Wharfe.	
Aire	815
Calder.	
Don	682
Trent	4,052
Derwent (Dy.).	
Meden.	
Soar.	
Tame.	
Witham	1,079
Welland	760
Glen.	
Nen	1,077
Old Nen.	
Ouse (Bd. and C.E.)	2,607
Little Ouse or Brandon.	
Lark.	
Cam.	
Wissey or Stoke	243
Nar or Setchy	131
Bure	348
Yare	880
Waveney.	
Wensum.	
Stour (Sk., W.)	407
Colne	192
Blackwater	434
Roding	317
Thames	4,613
Cherwell.	
Thames or Isis.	
Kennet.	
Wey.	
Mole.	
New.	
Lee.	
Darent	314
Medway	680
Avon (Wt. and H.S.)	673
Stour (Dt.)	459
Ex	584
Teign	203
Dart	200
Tamar	385
Torridge	336
Taw	455
Perret	562
Tone.	
Avon (Wt., Ss. and Gs.)	891
Severn	4,350
Avon (Wk. and Wr.).	
Teme.	
Wye	1,609
Lug.	
Usk	540
Towy	514
Cothi.	
Dee	813
Weaver	711
Dane.	
Mersey	885
Irwell.	
Ribble	585
Lune	418
Eden	915

SKETCH MAP OF
ENGLAND AND WALES,
SHOWING COUNTY BOUNDARIES
AND CATCHMENT BASINS OF PRINCIPAL RIVERS.
TILL
TYNE
EDEN
WEAR
TEES
DERWENT
LUNE
OUSE
RIBBLE
AIRE
DON
MERSEY
WEAVER
DEE
TRENT
WITHAM
WELLAND
NAR
WISSEY
BURE
YARE
NEN
OUSE
STOUR
SEVERN
WYE
TOWY
USK
THAMES
BLACK WATER
COLNE
ROD
ING
PARRET
AVON
MEDWAY
TOR
RIDGE
TAW
EX
TAMAR
TEIGN
DART
STOUR

Mr. Easton Devonshire (London) said that the Council of the Association of Water Engineers had requested him to represent the views of that Association as to the recommendation embodied in the Third Report of the Royal Commission on Sewage Disposal. That report dealt with two principal subjects (1) Trade Effluents, and (2) a new Central Authority.

As promoting the protection of the surface waters of the country, which were or could be rendered available as sources of supply, water engineers could not too highly value the scientific work done by the Royal Commission, nor, he thought, venture to criticise the conclusions logically deduced from the mass of evidence before it as to the best methods of giving effect to existing laws for the prevention of pollution of rivers.

The terms of reference to the Royal Commission were limited to what might be termed the more effective policing of that portion of the sources of water supply of the country which might be defined in relation to geographical boundaries, and Mr. Scoble's paper, he thought, did not intend to go beyond those limits. The Report recommended the formation of a certain number of Rivers Boards, controlled by a new Central Authority, as the best machinery for the protection and control of that portion of the country's water supply, and proposed that the Central Authority should have as permanent chief officers an administrator, a bacteriologist, a chemist, and a combined water engineer and geologist. It was clear, from a study of the report and the abstract of evidence, that the suggested composition of local and central authorities was, in the minds of the members of the Commission, such as would suffice for the effective protection of the surface waters to which the investigations of the Committee had been exclusively confined, and were it not for paragraphs 74 and 75 of the Report, he did not think that water engineers as a body could have much to say in such a discussion as they were then engaged in. But it appeared that, in the view of the Royal Commission, the Central Authority which it was proposed to set up primarily for the specific purposes dealt with in the Report, was also to be intrusted with the investigation of the whole subject of the water supply of the country. Now that subject involved considerations of the very greatest importance and complexity entirely outside the range of the questions on which the Commission took evidence, and as to which they had made practical recommendations. It was because they held that view so strongly that the Association of Water Engineers proposed to give its most careful attention to any Bill that might be brought in consequent upon the Report they were now discussing, and in the terms of a resolution adopted by its Council, "invited the County Councils Association, the Royal Sanitary Institute, the Underground Water Preservation Association, and such other bodies as it might consider likely to be of assistance to join with the Association in a deputation to the President of the Local Government Board for the purpose of urging upon him the desirability of further official enquiry into questions of water supply, and the taking of evidence from parties directly interested therein."

In considering questions of sanitation as relating to water supply, the members of this important Society, both individually and as a body, no doubt primarily considered the quality of water supplied, and rightly so. The requirements of public health involved, however, over a large part of the United Kingdom, difficulties which were much greater to deal with than those involved in maintaining the purity of existing supplies. He meant the difficulty of procuring or providing a supply of water at all. He mentioned two difficulties which were especially referred to by the speakers in the deputation to the President of the Local Government Board in October, 1902, a full report of whose remarks, together with Mr. Walter Long's reply, was appended to the Third Report of the Royal Commission. These two difficulties were the abstraction of the natural water supply of a district for conveyance and use elsewhere, and the limitation of the supply by water authorities to more than a portion of their statutory areas, or in the case of cities and towns, to their municipal boundaries. In the present state of the law, and the haphazard way in which the stronger pick and chose what they require from the country's water supply to the detriment of the weaker, it appeared to him that the first requirement to obtaining an equitable distribution of water supply was the preparation of a comprehensive survey of both surface and underground sources of supply. To accomplish this, it seemed indispensable that a Royal Commission or other body armed with the requisite powers of obtaining the required information should be appointed. In preparing this survey, the first work of this body would be the mapping out of all existing areas which companies or other water authorities were authorised by statute to supply, and the examination of the extent to which these powers had been exercised or otherwise; secondly, returns should be obtained as to the quantity of water available and used by existing water undertakings; and thirdly, as to the result of the statistical information so obtained, recommendations should be made for the amendment and consolidation of water Acts into a rational and comprehensive whole. They would see at once that the result of such a survey and inquiry would be the real, if not the administrative, division of sources of the country's water supply into areas which would for a great part of the kingdom not be coterminous with geographical boundaries, and would furnish the information, now generally lacking, as to what such areas are, and how the supply of water that could be obtained from them could be made available in the best interests of the community at large. The Association of Water Engineers would, to the extent of its powers, endeavour to collate some, at all events, of the information required through the very numerous water undertakings represented amongst its members; but it was evident that to make such a survey and inquiry complete required powers and finances which they did not possess. He believed that the work would be most efficiently carried out by a body of experts, such as might be formed jointly by the Association of Water Engineers, the Royal Sanitary Institute, the County Council's Association, and other kindred bodies, with the assistance of the leading geologists and water engineers of the country.

A joint committee of this kind would, however, require to be armed with the necessary powers for obtaining information and with funds from the Treasury.

Mr. H. J. Tingle, Lee Valley Drainage Commissioners (Westminster), premised his remarks by saying that he was only expressing his personal opinions. He thought that in the Rivers Pollution Act of 1876 the unit was too small. Matters had been better since the County Council had been made the authority; but even this unit was too small, and it would have been far better if it had coincided with the watershed area, and if the Rivers Board had been given greater powers of control than were conferred by the Act of 1876.

He understood the proposal was that the Rivers Boards be formed of representatives of County Councils in watershed areas to act as pollution authority, and to supervise water supplies, with powers of entry to take samples.

These matters were most important, but there were many others which should not be neglected, and should be entrusted to the Board: the straightening of the course of rivers, removing of shoals, weed cutting, flood relief works, construction of weirs, controlling flow of water, removal of dead animals, regulation as to washing animals.

There were also many conflicting interests involved: on the tidal portion of a river frequently those of navigation; on the canalized portion, navigation, urban and rural needs for water supply and disposal of sewage effluent, millers' rights, fishing, riparian owners.

The constitution of the Board should depend on duties to be undertaken. Assuming they included those enumerated, then urban and rural councils on banks be represented, and from outside authorities deriving supply from watershed similar to Lee Conservancy.

As to financial considerations, the cost of efficiently carrying out the duties of the Board would be certainly more than the amount now expended by the existing Boards, and the proposal appeared to be, they should be provided by county rates. In addition, local authorities on banks should contribute, and those drawing water supplies from the river, whether situated within or without the watershed.

The establishment of a Central Authority to determine areas of Rivers Boards and having general superintendence over them, and to collect information and advise on questions of river management and fix standards, etc., would be an advantage, but it was questionable if they should be granted further powers.

Much, however, depended on the constitution of the Central Authority, which was not clearly indicated.

But even if, as appeared to be suggested, the new Board was to be a department of a Government office, its decisions could not have the weight of that given by a court of law, neither would it be desirable that it should decide large questions of water supply and sewage disposal.

It was obvious that large communities must go outside their own watershed to obtain water, and it was quite inconceivable that they should relinquish their right to endeavour to obtain Parliamentary powers to abstract water, and for them to take in place a departmental decision arrived at after an inquiry, at which neither counsel nor expert witnesses were to be heard, except with the special permission of the Central Authority.

The Central Authority might fix standard effluents above and below intakes, and each river might be treated according to its own conditions.

They might also fix the amount to be paid by the authority taking water to local authorities above intake for extra cost involved in bringing effluent up beyond the standard required if the intake did not exist.

The question of high standard pressed very hardly on small authorities. Take the Lee, above the intake of the Metropolitan Water Board at Chingford Mill, the Conservancy now insist, in the interest of the Water Board, that the effluent shall reach a high standard, and several of the authorities are incurring heavy expenditure to meet the requirements. In such cases he thought the Water Board should grant a contribution to the authorities concerned equal to the extra cost incurred. This principle has been recognised. The Board, under old agreements between their predecessors, the Water Companies, and a Corporation, have to treat the sewage of the Corporation, and were about to entirely reconstruct the Disposal Works at their own cost, spending a sum much in excess of that needed if the water from the river was not required for London supply.

MR. R. O. WYNNE-ROBERTS (Westminster) said that after an experience of twenty-five years of local authorities as a municipal engineer he fully appreciated the difficulties they had to face in carrying out purification works, and he also understood the difficulty of inducing councillors to consent to the carrying out of such works, especially if it meant any increase in rates. They had parish councils, rural district councils, urban district councils, town councils, county councils, and now it was proposed to create rivers pollution boards, an additional authority which would mean further rates. He could not at present fully appreciate the necessity of having a board for every watershed or combination of watersheds, for the number would be great or the duties too onerous to be adequately fulfilled. Instead of another body being created he considered that the duty should be imposed on the county councils and made imperative. As to the question of the appointment of a central board he thought they were all agreed that it would be useful, in order to collate the information now to be found in a multitude of reports, and to generally supervise and urge the councils to perform their duties. But until the promised Bill had been introduced they were in the dark as to what steps should be taken in support of, or in opposition to the same. If the rivers pollution boards were to be elective, he thought they

would not do much better than the county councils; if, however, they were government departments, quite independent of elective votes, with power to enforce the necessary works, there was then a possibility of something being done.

Mr. W. Whitaker, F.R.S. (Croydon), said that the Royal Commission on Sewage Disposal originally had no power to deal with water, although at the end of its career it was suggested that it should deal with this. But its members were not water experts, and he believed he was right in saying that what water engineers and water authorities wanted was an independent inquiry on water supply alone. It was surely a big enough question to demand a special inquiry. Speaking of the fixing of watershed areas, he alluded to the difficulty of the work and added that different arrangements would be necessary for different parts of the country, as many of the towns in the Southern part of England drew their supplies from underground sources, and the underground water areas did not always coincide with the surface watersheds.

Mr. C. H. Ball (Withington) wrote: A deplorable fact which stood forth very conspicuously in relation to this subject was that the opinion of the sewage works manager was seldom sought, and in return seldom voiced. As one of that body and one who had been intimately connected with the body as a manager for some considerable time, he could not but feel that much valuable opinion and knowledge was being lost by this apathy. He had been engaged as a sewage works manager in various parts of the country, some of the works coming under the inspection of River Boards, some under Fishery Boards, and some receiving no inspection whatsoever, and he considered that, taken as a whole, the most economical and efficient works were generally to be found within those watersheds where the Rivers Authorities were most keenly alive to their responsibilities under the powers conferred upon them.

He heartily agreed with the suggestions put forward by the Royal Commission as far as related to the formation of Rivers Boards throughout the country, but thought that the subject was one which should engage their whole attention, without the addition of matter relating to public water supplies.

The recommendation of the appointment of a Central Authority did not appear to him to be warranted, for there was no section of the work which could not equally be undertaken by each properly constituted River Board. The end would be just as surely reached by intercommunication, which would tend to raise the efficient standard to which it would be found each Board would be striving to attain. Local authorities would also realise that as soon as all sources of pollution to rivers were subject to similar conditions of inspection, and their endeavours to prevent pollution, were being followed, compulsorily or otherwise, by other authorities using the stream, there would eventually be a greater willingness to meet the requirements of the River Board.

Finally, he hoped that the time was not far distant when the country would be mapped out into controllable watersheds, which in turn would be controlled

by efficient River Boards, who would have full power, after due consideration, to enforce their requirements.

Mr. E. Halliwell (Preston) wrote referring to the fact that the Ribble Watershed Joint Committee was constituted by a Provisional Order under Section 14 of the Local Government Act, 1888, in May, 1891. Its authority was limited to the Rivers Pollution Act, 1876, and in this respect differed from the Mersey and Irwell Joint Committee and the West Riding of Yorkshire Rivers Board, who, in addition to the powers under the 1876 Act, had each their own special Act of Parliament. Under the Act of 1876, the Ribble Committee could not take proceedings against manufacturers for liquid pollution without the consent of the Local Government Board; and under Section 12 of the same Act, the Local Government Board had power to grant a Certificate regarding the best or only practicable and available means for dealing with sewage pollution. His Committee had suggested to the Royal Commission alterations in the 1876 Act so as to include pollutions which are at present not dealt with. In his opinion, it was advisable to see how the Act which is said to have been drawn up by the Secretary to the Local Government Board dealt with these matters, and what powers were given to the proposed Board in addition to or in lieu of the powers at present vested in the Local Government Board before further publicly discussing the matter. With respect to the question of the new Board and water supplies, a definite statement as to whether it should be the duty of the Board to consider the interests involved in taking water from one watershed and delivering it into another watershed, or whether they should be responsible for the purity of the water supplies -although, in his opinion, the former was suggested by the Royal Commission—would be of great advantage in the consideration of the question.

Alderman Lamb (Bradford) said he had the opportunity of hearing Sir William Ramsay at the last meeting, and also the discussion upon the paper, but it seemed to him that the opinion of the present meeting differed from that of the previous meeting on the question of dealing with watersheds.

If it was proposed to give powers to a Central Authority or to River Boards to deal with both questions, what about the position of Municipal Corporations who had spent large sums of money, fought for and obtained Parliamentary powers, to provide water for their districts?

Again, if it was proposed to deal with watersheds, etc., why had not water engineers been called to give evidence before the Royal Commission?

In discussing the question without the Bill, it seemed to him they were discussing not principles but opinions.

His Corporation acquired the waterworks undertaking of the Bradford Waterworks Company in the year 1854 and supplied the whole of the city containing a population of 300,000. They also supplied other towns and districts in the neighbourhood of the city within their limits of supply, having a population

of about 200,000 persons, making altogether a total population of about half a million. In addition water was supplied for trade purposes. The quantity supplied was upwards of fifteen million gallons of water a day.

In order to be able to meet the obligations placed upon them by Parliament, the Corporation on several occasions sought the aid of Parliament for the purpose of obtaining further powers, and at the present time Parliamentary powers had been obtained to construct works and draw water from three different watersheds. This was necessary in consequence of the varying altitudes of their water limits, which ranged from 200 feet to 1,200 ft. above sea level.

In each of these watersheds the Corporation had either acquired large tracts of land, or arranged with the landed proprietors for the purpose of protecting the drainage areas.

They had incurred heavy obligations and had spent large sums of money in order that the people within their area of supply should get a pure and abundant water supply, and they saw no cause for interference in any way by any Government Board with respect to drainage areas or watersheds already appropriated to them by Act of Parliament. Any resolution which proposed to grant the powers indicated by Sir William Ramsay ought to limit the recommendation to unappropriated areas or watersheds.

The Corporation were against any power being granted to River Boards for inspecting or otherwise interfering with any portion of their works, and they were opposed to the proposed Central Authority and the setting up of a Department in London with practically unlimited powers.

Parliament for many years had moved in the direction of decentralisation, and the Corporation considered the present suggestion would be a retrogade movement.

Dr. H. Maclean Wilson (West Riding of Yorkshire Rivers Board) suggested that owing to the want of a definite Bill to discuss, the speakers had in some respects gone greatly astray. There were before the meeting the excellent papers of Sir William Ramsay and Mr. Scoble, but the real subject of discussion was the Central Authority which Mr. Burns proposed to set up according to the recommendations of the Third Report of the Royal Commission. The main object of the Central Authority, suggested by the Commission, was to deal with questions relating to the admission of trade refuse to public sewers, and that aspect of the question had not been dealt with by any of the speakers. It was, however, a very important matter in some parts of the country. For example: in the West Riding there were 2,000 traders turning out trade refuse, half of them into sewers, the other half into streams, and many questions as to admission of the refuse into the sewers involving expensive litigation had arisen.

This part of the subject was, in his view, so important that he hoped the meeting would come to no definite resolution until there had been opportunity for its full discussion.

On other points the speakers had gone astray. The Royal Commission had

not suggested that they or the Rivers Boards should control public water supplies, but merely that the proposed Central Authority should obtain information about them. A body such as that suggested by the representative of the waterworks engineers for the purpose of reporting on the whole subject of water supplies would not command the confidence of the public. The matter was one which should be dealt with by a Central Government Department.

Alderman Johnson (Bradford) said he had had no intention of taking part in the discussion, but the remarks of Dr. Maclean Wilson, of the West Riding Rivers Board, on the question of admitting liquid trade waste into the public sewers called for a word or two. In his opinion it would be a great cost to the general ratepayers if manufacturers had an unrestricted right of entry into the public sewer. Local authorities ought to have power to regulate the flow (to spread it over the twenty-four hours), and to make a charge according to the quantity and the nature of the impurities.

Mr. Hugh P. Raikes (Westminster and Birmingham), said that since River Boards had been definitely recommended by the Royal Commission on Sewage Disposal, it seemed to him that the mere criticism of their proposal was unlikely to serve any useful purpose unless it was accompanied by some practical suggestion for meeting the difficulties complained of.

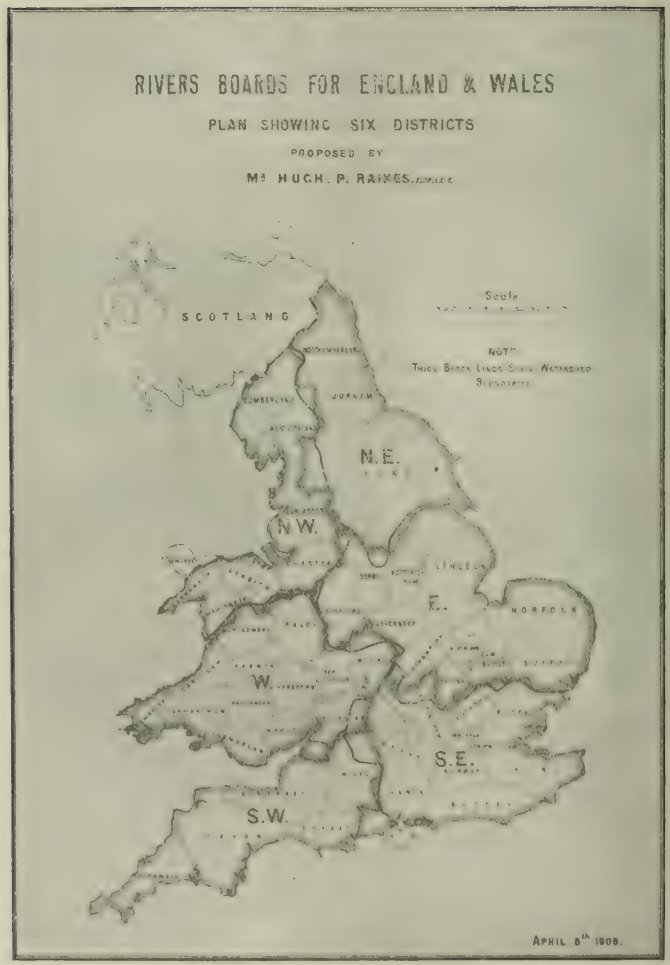
When this subject was previously discussed he made three tentative suggestions with a view to eliciting the opinions of others on what seemed to be the first points to be considered, the number and scope of the River Boards proposed by the Commission for England and Wales.

He then suggested that the number should not exceed *six* and their responsibility should be limited, at any rate, in the first instance, to "*gaugings and standards.*"

These six authorities would each control a group of counties, and might be conveniently distinguished as the N.W., W., S.W., N.E., E., and S.E. Counties River Boards, thus avoiding interference with the existing system of county administration as far as possible, and although it would be seen from the map (p. 218) that the boundaries of these six districts did not exactly correspond with the watershed boundaries, they were so near that far less practical difficulty was likely to arise on this account than if a larger number of smaller authorities were constituted.

By adopting this suggestion it would be possible to utilise the River Boards already existing in Lancashire and Yorkshire, together with the Thames Conservancy Board as the basis for the North Western, North Eastern, and South Eastern Counties River Boards respectively, so that only three entirely new authorities would have to be constituted, and those which had already done good work would only be re-organised with extended jurisdiction.

In Mr. Scoble's "list of subjects within the scope of Rivers Boards" it


RIVERS BOARDS FOR ENGLAND & WALES
PLAN SHOWING SIX DISTRICTS
PROPOSED BY
Mr HUGH. P. RAIKES.
SCOTLAND
Scale
NOTE
CUMBERLAND
DURHAM
M.E.
N.W.
E.
NORFOLK
W.
S.E.
S.W.
APRIL 8th 1908.

seemed to him that all those under the heading "A" related to the chief causes of river pollution which could best be prevented by enforcing such "*standards*" of purity as might be found reasonably practicable in each district, while the subjects under heading "B" referred to questions of water supply which were mainly dependent on "gaugings" of rainfall and stream flow, together with the investigation of underground supplies.

The subjects mentioned under the remaining five headings were to his mind beyond the scope of this discussion, except in so far as they were connected with the questions of pollution and water supply under the preceding headings "A" and "B," and the Commission's Reports did not seem to justify the view that the constitution of Rivers Boards would interfere with existing water rights, or the administration of existing water supplies.

The speakers that evening included the representatives of many important interests which were directly affected by the proposal under discussion, and he was very pleased to find that their remarks indicated no disagreement with the views which he expressed two months ago, in fact his suggestions had been practically endorsed by the first three speakers who had respectively advocated: -

1. The investigation of water supplies, including "gaugings."
2. Large districts in preference to small ones.
3. Preventing pollation by enforcing local "standards" of purity, but avoiding interference with local administrative responsibility as far as possible.

MR. SIDNEY R. LOWCOCK (Westminster) wrote that he was very glad the discussion was to be continued, as it appeared to him that at the meeting on February 12th the main point was neglected by the majority of the speakers.

As he understood it, the real matter for discussion was: Were they in favour of the establishment of River Boards under a Central Authority or not? Personally he was in favour of the establishment of such Boards.

In the first place he felt there could be no doubt that most of the difficulties which now existed, both in connection with water supply and drainage, would disappear if the watersheds were made the areas over which efficient central control could be exercised by one authority, instead of having, as at present, several authorities in one watershed, and in many cases the district under one authority extending over parts of several watersheds.

If such Water Boards were established they would, or he presumed they would, keep proper records of the rainfall over the whole of each watershed, and gaugings of the flow of the river or rivers and streams in such watershed; and these records would be of inestimable value for purposes both of water supply and of drainage, as well as for river and canal work.

Engineers would then have accurate data on which to base their schemes, instead of having to estimate what the rainfall, evaporation, and run-off were likely to be from data obtained from gauges hurriedly set up in arbitrary positions and observed for only short periods, and the result would be an enormous saving

to the public in the cost of the schemes which could be much more accurately designed.

These were matters which did not fall within the province of the county councils, nor, in fact, of any authorities, but were at present left to the voluntary efforts of private individuals, who took a great deal of trouble and incurred considerable expense, and to whom engineers and the public generally were very much indebted.

Where public authorities or companies owned waterworks, and in some places where river conservators and canal companies controlled the streams and waterways, records of rainfall and river gaugings were kept by such authorities or companies for their own purposes, but were not generally available except under special circumstances, and even then the observations only covered a small part of the area of each watershed.

With reference to flood prevention works too it was absolutely necessary that the whole watershed should be controlled by one authority.

The question of river pollution was within the province of the county councils, and many of these had done, and were doing, excellent work in the prevention of pollution; but here again the difficulties of restricted area were very apparent, the methods and requirements in one county not being the same as those in an adjoining one in the same watershed, while in some cases the active and vigilant control exercised by one authority is rendered almost nugatory by the inaction of its neighbour.

A county in the lower part of a watershed has no control over the collecting area at the upper part of the same watershed, even when the water collected in such upper area is distributed for domestic purposes by public authorities or companies in the lower area.

An additional and very cogent argument in favour of the establishment of authorities having jurisdiction over wider areas was the local influence which could be, and was, brought to bear on the smaller, and to a lesser extent on the larger, existing authorities to prevent or hinder the necessary steps being taken to remove pollution.

The few existing River Boards showed that an immense amount of good could be done by a strong authority having a large area, but the powers of those Boards were not exactly the same, and additional powers were wanted.

The various River Boards must be under one Central Authority in order that they should all be brought into line and work on the same basis, as otherwise it would be extremely unfair to local authorities and manufacturers in one watershed to be compelled to comply with the requirements of one Rivers Board, while their neighbours and competitors in another, possibly adjoining, watershed were under less stringent regulations.

He thought the Central Authority should be attached to the Local Government Board, because all the matters which would come under the control of the River Boards were now dealt with from time to time, although necessarily in a disjointed way, by this department.

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DIPHTHERIA IN ELEMENTARY SCHOOLS AND ITS PREVENTION.

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Medical Officer of Health, City and Port of Kingston-upon-Hull.

Read at Sessional Meeting, Hull, April 4th, 1908.

DIPHTHERIA is the result of the local development of a specific micro-organism (the *Bacillus diphtheria* of Klebs and Loeffler) which attacks the mucus membrane of the respiratory and alimentary passages, the system afterwards becoming generally infected, the infection being the result of the absorption of toxins locally produced in the throat.

The organism known as Klebs bacillus was discovered by Klebs in 1883, and was cultivated by Loeffler from diphtheria cases in 1884.

Since the discovery of the specific cause of diphtheria the application of bacteriology has taught us to differentiate between diphtheria and the conditions indistinguishable from it, and to discover the means by which infection is constantly spread.

From a public health point of view, it is all-important to distinguish diphtheria on the one hand from the non-diphtheritic inflammatory conditions of the throat on the other, and since we are now able to recognise the special organism, when present, we anticipate with the adoption of proper sanitary precautions, not only to lessen the prevalence of, but also the mortality from the disease. Further, with the introduction of antitoxin, discovered by Behring and Kitasato in 1890, we hope to still further reduce the mortality.

Some thirty years ago diphtheria was far more prevalent in rural than in urban populations, but latterly it has considerably decreased in the rural and increased in the urban districts.

Diphtheria has a tendency to become epidemic in years in which the rainfall is deficient, and such epidemics have a tendency to be more severe in type and attended with greater mortality when three or four years of deficient rainfall follow each other.

The seasonal prevalence of diphtheria shows a relation to cold weather, both its prevalence and mortality being greatest during the quarter ending December, whilst the lowest occurs during the quarter ending June.

Like other zymotic diseases, diphtheria is subject to periodical increases and decreases, and regard must be had to its acknowledged cyclical nature. Its history shows both longer and shorter cycles, some lasting several decades, others only a few years.

It has been noted by Dr. Davies (Bristol) that at one time in the same town, the type of the diphtheria bacillus may be distinctly different from that found at another time, and the differences of type are accompanied by different habits of the disease, both as to fatality and infectivity.

Prior to the year 1900, according to Dr. Davies, the mortality from diphtheria in Bristol was singularly and consistently low. School outbreaks were practically unknown, and hospital accommodation was apparently needless.

In 1900 the disease became much more fatal, and the bacilli found were typical in form. This new and virulent variety of the disease gradually spread over the city. In 1902 school outbreaks occurred and became urgent, widespread, and difficult to control. Dr. Davies believes that in such a period as preceded 1900, normal resistance to the disease is sufficient to protect the majority against even the parasitic attachment of the existing type of the bacillus, so that the "carrier" cases are rare, and the clinical cases well marked.

Diphtheria is particularly a disease of the young, occurring principally between the ages of two and eight years, and is, therefore, a disease of school life, and the children are attacked usually within a very short time of their admission to school.

Age is also an important factor, and it is interesting that the two sexes are differently affected. In the first years of life, boys are more liable to die from the disease. This liability diminishes year by year, and in the third and fourth years it is transferred to the female side.

The greatest attack rate occurs generally between four and five years, children under one year being remarkably exempt, due possibly to their sleeping with their parents instead of with other children. Direct infection from person to person is perhaps by far the commonest form of spreading diphtheria.

There is no doubt that school life plays an important part in the spread of diphtheria, and is also a factor in the increasing prevalence of the disease amongst our urban populations.

At the present time there is a large number of children under five years of age receiving instruction in elementary subjects, which is at an age when the brain is not sufficiently developed to benefit by it. It has been stated that some £1,250,000 is annually expended on this unnecessary and educationally useless attendance.

In England and Wales in 1903-4, some 7,047,770 children, or about one in six of the entire population, were attending public elementary schools, and according to a return of the Registrar-General, it has been estimated that there were some 722,206 children between three and four years of age, and 715,897 between four and five years; 27·2 of the former and 58 per cent. of the latter were attending such schools.

Few educational advantages are derived by the attendance at school of children under five years of age, and apart from the children being exposed at the most susceptible periods to all kinds of infectious diseases, thus endangering their lives, as the proportionate mortality is known to be greatest under five years of age, it is injurious to their physical and mental welfare.

Experience has demonstrated that the spread of diphtheria is frequently attributable to children suffering from mild and unrecognised attacks of the disease, or to children who have been exposed to infection and continue to attend school (members of the same family often attending more than one school), and although themselves apparently well, may have diphtheria bacilli in their throats or nasal organs, and thus infect healthy or susceptible children.

Owing to the aggregation of children, schools of themselves are a common source of spreading infection, especially amongst the infant and junior classes.

According to Dr. Kerr, Medical Officer to the London County Council Education Committee, children found to be spreading diphtheria in schools may be divided into four classes, as follows:—1. Actual mild cases in attendance. 2. Cases coming from infected houses, but presenting no symptoms. 3. Cases of recrudescence after absence for notified diphtheria (return cases). 4. Carriers without symptoms or demonstrable contact.

Common cold and sore throat are often the precursors of diphtheria outbreaks in schools. When a case of diphtheria is discovered, the patient should be at once isolated in hospital or at home, and members of the family should be kept from school. I might here urge the importance of

sufficient hospital accommodation being provided for all cases requiring isolation; and in this respect public health authorities must not overlook the demands of the ever-increasing populations of our large centres.

A medical inspection of the family and of other children of the class or school should follow, swabs should be taken from their throats for bacteriological examination, and in cases where the presence of diphtheria bacilli are shown to be present, the children should be excluded from school and not allowed to return until they have been declared bacteriologically to be free from infection. Teachers should be instructed in the early symptoms of diphtheria and encouraged to report them. During epidemic periods there should be frequent medical inspection of the schools. Further, infected contacts and those who have been exposed to infection should be injected with a prophylactic dose of antitoxin. The protection afforded by such treatment lasts about three weeks, and if the throat is not clean at the end of that time the dose should be repeated.

Another point which should not be overlooked with regard to diphtheria is that discharges from mucus membranes are exceedingly prone to recur, and after a patient has been declared to be convalescent the discharge, on exposure of the individual, may recur and become a probable source of infection.

Antitoxin for the treatment of diphtheria came into general use in the year 1890. We in Hull introduced it into our hospitals in November, 1901, and its use has been attended by most favourable results, followed by a reduction in the severity of the symptoms and reducing the number of cases otherwise requiring tracheotomy, and in cases requiring tracheotomy which have been previously treated with serum the mortality has been reduced.

The statistics of the Metropolitan Asylums Board, 1890–1893, before antitoxin was used, show that 7,111 cases of diphtheria were admitted into their hospitals, of which 2,161 died, a mortality of 30·29 per cent.

In 1893, in which year antitoxin was first used, there were 3,042 cases and 902 deaths, a mortality of 29·65 per cent. Since then the mortality has been steadily decreasing every year, until in 1903 there were 4,839 cases with 493 deaths, a mortality of 10·18 per cent.

Dr. Hallock Park also provides us with conclusive evidence in this direction, for he says:—

> "He has put together the whole of the statistics as to deaths and death-rates from diphtheria and croup collected in a large number of the largest cities of the United States, France, Germany, and Austria. These combined statistics go to prove, and to prove most conclusively, that in 1881, in a population of 13½ millions living in these cities, there were 13,897

deaths from diphtheria and croup, constituting a rate of nearly 102 per 100,000 living. In 1884 the rate had fallen to 85·2, in 1891 to 70; in 1894 it had risen again to 79·9. In 1895, the first real antitoxin year, it had fallen to 55·6, the most marked fall ever recorded up to that time, and since that date there had been a steady and uninterrupted decrease that has never been equalled since the disease was first recognised. In the first antitoxin year the death-rate fell lower than it had ever reached before, and finally to less than one-third of what it had ever been before the first antitoxin year."

In answer to a series of questions which, a short time ago, I addressed to the medical officers of health and medical superintendents of infectious diseases hospitals of the principal large towns in the United Kingdom, they were unanimous in expressing themselves as to the favourable results and benefits conferred by antidiphtheria serum and the reduction of mortality consequent upon its use.

One of the objections raised against the treatment of diphtheria by antitoxin is that paralysis has followed. This is erroneous, and I think that Dr. Hutchens has well said that

"Paralysis occurring in persons who have had antitoxin inoculated is due to the absorption of diphtheria toxins. Paralysis is perhaps more frequently seen since antitoxin was introduced. But why? Simply because antitoxin has been used in such cases in time to prevent a fatal issue ensuing, but not soon enough to neutralise the toxin formed early on in the disease. This early-formed toxin was absorbed and entered into chemical combination with the cells of the body and damaged them; had antitoxin not been used more toxin would have been absorbed and combined with the cells, and death would have resulted. Antitoxin prevented death, but was powerless to neutralise toxin which was already fixed at the time it was inoculated."

As previously mentioned, diphtheria is the result of the local development of a specific micro-organism in the throat, and some have advocated the destruction of the bacilli in the local part affected from which the disease is disseminated.

It is essential that all schools should be efficiently lighted and ventilated, regularly cleansed, and that their general sanitary arrangements should be above suspicion. The use of sponges should not be permitted, paper should be substituted for slates, and when found necessary all books in use should be either destroyed or submitted to disinfection by formic aldehyde. The schools themselves should also be thoroughly disinfected with formic aldehyde, and the walls, floors, and desks sprayed with a solution of formalin.

In the light of science of to-day, it is seldom necessary to close a school owing to the prevalence of diphtheria, as if early precautions are taken it may be prevented from assuming epidemic proportions. We have no such

ready means of applying bacteriology for the early recognition of other infectious diseases.

In conclusion, I would remark that if infectious diseases are preventable, why not prevent them? It is by means of sanitation, notification, disinfection and control of susceptible contacts, and by the early application of the most recently introduced treatment, that we may hope to ameliorate and possibly eventually to eradicate diphtheria.

With the facilities afforded by the establishment of public health laboratories, under the supervision of expert bacteriologists, and with the appointments which are now being made under the provisions of the Education Act, 1907, for the medical inspection of school children, much benefit will doubtless accrue, not only as regards the physical welfare of our rising population, but also for the prevention of infectious diseases, whose secondary complications often lay the foundation of future ailments which leads to the deterioration of our race.

In the preparation of this paper, reference has been made to the following writings:—

Address by Professor Sims Woodhead on "Anti-Bodies." *Journal of Royal Institute of Public Health*, September, 1907.

Article by H. J. Hutchens on "Diphtheria; its Prevention and Treatment." *Public Health*, March, 1906.

"The Prevention of Infectious Diseases." By Dr. John C. McVail.

Moor and Hewlett's "Applied Bacteriology."

Dr. R. H. Crowley (Bradford) confined his remarks to diphtheria in relation to the school. He thought it important to consider the increase in diphtheria from two points of view: (1) The causes leading to the greater or lesser virulence of the bacillus: (2) The methods by which an epidemic spreads. So much did personal contact in school overshadow all other means of spreading the disease that it was necessary to insist on this, and to endeavour to get administrators and the public generally to understand that improvements in sanitation as generally understood would not prevent the disease spreading. In spite of sanitary progress diphtheria had greatly increased. An example of the futility of mere school closure was then given, and the result eventually of an examination of the throats by means of swabs was detailed; it was found that 42 children out of 93 were acting as carriers of the bacillus. In no case were bacilli found in the throats of children used as controls, the same methods of staining, etc., being employed. Dr. Crowley detailed the methods which it seemed best to employ if diphtheria arose, children being singled out for one reason or another and their throats bacteriologically examined. It was further necessary that no child who had diphtheria should be allowed to return to school until bacteriological exami-

nation was negatived; and the same rule should be applied to children from the same house.

The prevention of diphtheria entailed considerable cost, but the cost of treating the disease if not prevented would be much greater. As in other departments of public health, our knowledge as to what ought to be done is much in advance of what is done.

Dr. J. M. Clements (Hull) supported the views of Dr. Mason and Dr. Crowley regarding the important role played by carrier cases in the spread of the disease.

As illustrating the rapid way in which the diphtheria bacillus diffused itself among a collection of children, he instanced two outbreaks of diphtheria which occurred among scarlet fever patients under his care.

The first outbreak was in a female scarlet fever ward containing 31 patients. Two cases of diphtheria occurred within two days. Swabs from the fauces of the remaining 29 showed that 10 of them were harbouring the diphtheria bacillus.

The second outbreak was in a male scarlet fever ward containing 29 patients. One case of diphtheria occurred, and, on swabbing the other 28 patients, 11 of them were found to be "carriers."

To prevent the spread of the disease, the only precaution adopted was to inject every patient with a small dose of antitoxin. No further cases of diphtheria occurred. Such figures, together with others which have been accumulating in recent years, show that the Klebs-Loeffler bacillus spreads very rapidly among children aggregated together, and also that the protection afforded by a small injection of antitoxin is absolute for a short period.

The question of the value of antitoxin in the treatment of diphtheria had passed out of the field of discussion. Antitoxin was now a universally adopted and highly valued remedy. Here and there voices were still raised against its use, but they attracted little attention.

In reviewing the grounds of their confident belief in the efficacy of antitoxin, the figures quoted by Dr. Mason, comparing the case mortality before and after the introduction of serum treatment, were very striking; but the following facts detracted from their value. (1) Diphtheria was a disease which exhibited great variations in virulence when studied over a period of years, so that a fall in the mortality could not at once be attributed to the use of the remedy then in vogue. (2) The name diphtheria had now a much wider application than in days gone by. Formerly the disease was diagnosed by the presence of false membrane on the fauces, accompanied by severe constitutional symptoms. Now a diagnosis was made almost entirely by bacteriological examination, the presence or absence of the Klebs-Loeffler bacillus being the criterion whether they were dealing with diphtheria or a simple form of sore throat. As a result, mild sore throats, which formerly would not have been regarded as such, were now classified as diphtheria cases which would get well

under any form of treatment, and the mortality from diphtheria was thereby lowered.

Although the above figures might not be entirely relied upon, they still had convincing evidence in favour of antitoxin. It was afforded by (1) the diminished number of laryngeal cases among those treated with antitoxin. He had never seen the disease spread to the larynx after a case had been injected with antitoxin. It could not be too frequently repeated that antitoxin, given early, prevented the most dreaded form of the disease. (2) The most convincing proof of the efficacy of antitoxin was that afforded by the increasing mortality according as cases came under serum treatment on the first, second, or later days of illness.

The mortality among cases of diphtheria coming under his care from 1903 to 1906, classified according to the day of disease on which serum treatment commenced, showed that of those coming under treament on the 1st day the mortality was nil: 2nd, 1·5 %; 3rd, 8 %; 4th, 15·7 %; 5th, 19·8 %; 6th, 24 %. These figures tallied very closely with the much larger figures collected by Dr. McCombie, of the Brook Hospital. They showed the great importance of giving serum early in the disease, and the large number of lives that would be saved if all cases came under antitoxin on the first or second day of illness.

Mr. W. R. Locking (Hull) said that while he agreed that seven years might be a more suitable age for children to attend school than three or even five, yet in Hull they had recognised that some of the children at an earlier age were better in school than in their unhealthy home surroundings. It was impossible to teach children, say, of three years of age, even the rudiments of the three R's, and their ideal was to have a department that would be practically a nursery. After listening to the paper and discussion, he thought some of the epidemics of diphtheria in Hull had been caused by carriers instead of, as he had thought, by the sanitary defects of the school.

Alderman W. Holder (Hull) gave instances in which diphtheria patients had been treated at their own homes, and there had been very few, if any, secondary cases. He held that the disease was contagious. He treated the disease, not with antitoxin, but with local applications and medical treatment according to the condition of the mucous surfaces. He regretted there was not a uniform standard for statistics. It was impossible to generalise from different standards. It would be well if there was an authorized audit of statistics. He produced 302 returns from an official bacterial investigation establishment; of these, 126 were declared positive, and 176 as negative. Of the positive cases 125 were treated with local application, with 9 deaths, or 7·2 per cent.; of the negative cases none died. Most of the 176 cases came from the same institution as the 125 cases, and clinically most of them presented appearances and symptoms of true diphtheria.

He mentioned six schools in Hull at which outbreaks had occurred, and expressed the view that the diphtheria bacillus went from the throat through afflicted parts into the water-closets of the schools, and undoubtedly these were the centres of contagion. He had traced some 76 of these school children to their homes, and only found 3 houses with secondary cases in the whole of these 76.

Dr. J. Mitchell Wilson (Beverley) said that next to the successful means of stamping out smallpox, medical science now enabled us to act with more hopefulness at every stage in dealing with cases of diphtheria than with any other dangerous disease.

Bacteriology enabled a certain diagnosis to be made of those doubtful cases of sore throat, declared them to be cases of diphtheria or to be simple and non-infectious; but of far more importance, it often detected infection among persons who were not suspected, for in those *carrier* cases a bacteriological examination detected the bacillus of diphtheria ready to infect susceptible persons.

It was by such cases that so many of our outbreaks of diphtheria were kept up often for long periods. The cause also suggested means of prevention, viz., a bacteriological examination of all the contacts in a class in a school, or in country districts it might be of all the scholars at the school, so as to detect all such cases of unsuspected infection.

The bacteriological examination also told us when the case of diphtheria was free from infection; indeed, the negative result of a bacteriological examination should now be looked upon as the only trustworthy guide for the return to school of all children who had had diphtheria, of contacts, and of carriers.

But science had done more than tell us of the existence of diphtheria, for it had provided a serum, by the use of which in the early stages the death-rate had been very largely reduced.

He considered that every patient should be given the benefit of the use of serum, and in the East Riding that was now made possible through the action of the several urban and rural district councils.

Further, to meet the cost of the systematic use of a bacteriological examination in all cases of diphtheria, or suspected cases among school children, the County Council paid four-fifths of the expense incurred by the District Councils.

Dr. B. J. Stedman (Ricall) said that in two schools he had taken swabbings from all the children, and they had been able to stamp out the disease. Carrier cases were no doubt the main factor in the spread of infection. He believed in serum treatment.

Dr. Alfred Robinson (Rotherham) also spoke on the value of the free use anti-diphtheric serum, and stated that it was the custom in the Borough of

Rotherham for the Medical Officer of Health to keep a stock of antitoxin at the Public Health Office, and supply it to practitioners free in cases where the people were not in a position to pay for it. Although not strictly in accordance with the Public Health Act of 1875, the Health Committee made this gratuitous provision as they recognised the great importance of this serum as a preventive and a curative remedy.

He had found this provision a most useful one, and from his experience also urged the high importance of an early application of a large initial dose, ranging from 6,000 to 8,000 units according to the seriousness of the case.

Dr. James Fraser (Hull) expressed the hope that education authorities would consent to the isolation on suspicion and without definite diagnosis. He would point out that a school doctor under the new Act was supposed to look after 1,600 children, and if they took swabbings for all it would mean a great deal of work for somebody.

Dr. J. Spottiswoode Cameron (Leeds) wrote: In regard to the prevention of outbreaks in schools, it seemed to him that it was essential (1) that when a first case of diphtheria (in child or adult) was heard of in any house it should be watched (not necessarily hospitalled), and no child allowed to attend school from that house until the patient had been well for several weeks, and his throat and those of the school-going members of the family proved free from diphtheria bacilli.

(2) That hospital isolation should be much more largely resorted to than in the past, and that provision should be made in the presence of epidemic-favouring conditions for the isolation of members of infected families.

(3) That teachers should be instructed in the early symptoms of diphtheria and encouraged to report them to the sanitary authority. In the great majority of cases it was unnecessary to close the school; where circumstances compelled this, it was usually only the infant department that required to be closed.

(4) That in infant departments, three or four children should not be placed on one small seat. It was sometimes a convenience for a teacher to have the heads of the children close together; it was a great disadvantage to the children.

(5) That when a case had occurred in a school, all books, slates, and papers, used by the same class, should be disinfected by steam. There was no objection to disinfecting and cleansing the whole school as well, but the articles used by the child should certainly be disinfected.

Dr. Mason replied to the discussion, and especially referred to the question of expenses incurred in dealing with epidemics. The ideal of sanitary administration was preparedness, and the necessary arrangements ought to be well thought out in the absence of epidemic periods.

He also further emphasised his opinion that children under five years of age

received little, if any, advantage in attending school, as at that period many diseases of school life were contracted, and often laid the foundation of more serious ailments.

He concurred that with the early treatment of cases of diphtheria with anti-toxin the most favourable results followed, that the mortality from the disease by its use was reduced, and that this form of treatment now admitted of no doubt.

The Mayor of Rotherham (G. H. Lodge) and Councillor Raine (Hull) also took part in the discussion.

A visit was made to the disinfecting station, a plan of which is given on page 232.

The station which cost, including furnishing, £5,000, is isolated and easy of access, and is provided with waiting-rooms, bath-rooms, etc., containing accommodation for both sexes, to which persons who have been exposed to infection can be removed for the purpose of bathing and the disinfection of their clothing.

Should a vessel arrive in the port with infectious disease on board, in addition to the infected person being removed to hospital, the whole of the ship's crew and effects may be removed to the disinfecting station, whilst the ship itself is undergoing disinfection.

All the most important requisites of a disinfection station are provided, the accommodation being as follows :—

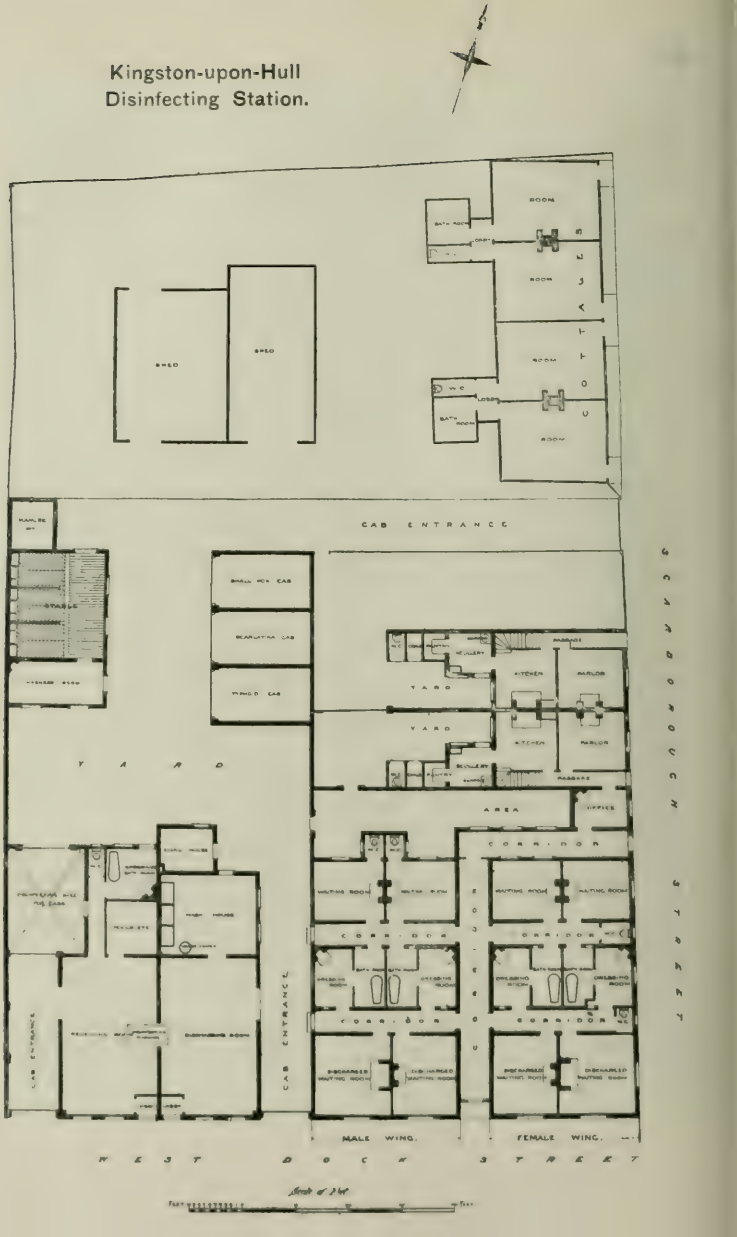
Disinfection Block (Clothing, etc.).—Receiving room, discharging room, disinfecting chamber for cabs, operatives' bath-room, sanitary convenience, tool-store, wash-house and boiler-house.

Disinfecting Block (Personal).—Two waiting rooms for males, two for females, two bath-rooms for males, two for females, two dressing rooms for males, two for females, two (discharged) waiting rooms for males, two for females, office, sanitary conveniences, night shelters (10 beds).

Stables, etc.—Three-stall stable, harness-room, manure pit, three cab sheds.

At the wash-house every provision is made for soiled articles being washed which are in such a condition as not to admit of proper disinfection.

Kingston-upon-Hull
Disinfecting Station.



INFECTIOUS DISEASES.

By H. CUMPSTON, M.D.,

Medical Officer of Health, Central Board of Health, Western Australia.

(Read before the Society of Sanitary Inspectors of West Australia.)

LET me draw your attention to the remarkable change that has come over the scientific attitude towards infectious diseases. Some diseases have always been recognised to be distinctly infectious. No person is ever under any delusion as to the infectivity of gonorrhœa or syphilis, for example.

Thirty years ago, on the other hand, it was thoroughly believed that malaria and yellow fever were due to the damp air arising from swamps and marshes; the miasma, as it was called. Now we know beyond doubt that the infection is carried by mosquitoes, and by mosquitoes only; and that these mosquitoes obtain their infection from a person suffering from the disease under consideration.

That is the point that I desire especially to bring under your notice. Infection takes place from man to man: either directly and obviously, as in smallpox, measles, or the venereal diseases; or indirectly and by means of an intermediate agent, as in malaria or yellow fever. We are very rapidly passing from the stage when we speak of the mysterious emanations from swamps or drains which produce horrible diseases, and we look now for the man who is scattering infection around him. Thus our knowledge is as rapidly becoming definite and sure. This knowledge has two results: it prevents the fear that epidemics bring, and it provides more intelligent and accurate methods of fighting these epidemics. It would, perhaps, be interesting to consider two or three of the infectious diseases more in detail; some (*e.g.*, the venereal diseases, puerperal fever, and beri-

beri) are not of sufficient epidemiological importance in this community to make it worth while discussing them. Others (cholera, or yellow fever), while they have not yet invaded this country, are still to be borne in mind; for we are so close to India that cholera is always a possibility, and the particular mosquito that carries yellow fever is to be found in great numbers in Perth, and with the opening of the Panama canal yellow fever will always have to be remembered.

Scarlet fever, measles, and chicken-pox are not important enough in this country at present to make it worth while spending time on them to-night. The respective deaths from these three diseases in West Australia during 1906 were seven, five, nil.

Plague.

It is now an old story to all here that plague is, from an epidemiological point of view primarily a disease of rats and is conveyed to man by fleas. That it is conveyed by fleas from rat to man infinitely more often than from man to man. Fortunately, West Australia has been free from human plague now for about two years, but this fact must not induce a false sense of security, for there is no reason for assuming that there is no plague still remaining amongst rats. As a matter of fact, it is known that plague often exists in a chronic form amongst rats, and therefore it is incumbent on all who are in positions of authority to maintain vigilantly the campaign against rats.

Enteric Fever.

This disease and its ally, summer diarrhœa amongst children, causes the great majority of the deaths in West Australia. The number of deaths from these two diseases was, in 1906, 564. The total deaths were 3,084, *i.e.*, in every 6 people that died, more than 1 died from these affections. How is enteric fever spread?

(a) By means of the water supply.

1. From time to time the water supply has come under censure as a means of spread of many diseases, but authorities are coming to look on water as a means of spread of enteric as a much less likely factor than was once thought.

There is some evidence, that is worth quoting. The figures for typhoid deaths for the central and eastern divisions for the last six years, *i.e.*,

before and after the inauguration of the new water supply to the goldfields, are :—*

Number of Deaths from Typhoid.

Year.	West Australia.	Goldfields.	Per cent
1901	120	60	50·0
1902	181	76	41·29
1903	132	40	33·33
1904	87	24	27·59
1905	107	19	17·76
1906	128	45	35·16

The new supply of water to the goldfields was inaugurated early in 1903, and it is seen that there is no appreciable alteration in the figures for typhoid during the next three years.

2. In India, Bengal Province, during 1860–1899, the deaths per 100,000 from enteric fever rose from 2·88 to 7·81, while the same figures for cholera fell from 8·86 to 1·25.† Cholera we know to be very frequently water-borne, and the decline was due to the marked improvement in water supply during these years. But this improvement in water supply did not prevent a marked rise in the death-rate from enteric fever in the same time.

3. In a report for the County of Surrey in England,‡ 2098 cases of enteric occurred in 12 years, without a single case being traceable to water contamination.

On the whole, then, water is not so important as used to be thought.

(b) In England, shellfish, watercress, etc., are frequently grown in places selected as being well supplied by sewage, and these articles of diet have often been found to produce small outbreaks of enteric fever.

(c) Milk is a medium in which typhoid bacilli will grow rapidly and well. The contamination of a milk supply at any point between the cow and the consumer is sure to be followed by some cases of enteric fever. The means of spread of enteric which is now recognised to be the commonest in India (and the same factor was undoubtedly the reason why enteric was so common during the war in South Africa) is as follows :—

A patient recovers from enteric, but, while he is free from symptoms himself, he may still continue to pass large numbers of typhoid bacilli in his urine and fæces. This occurs in only a small percentage of cases, but

* *Statistical Register*, West Australia, 1906. † *R.A.M.C. Journal*, Dec., 1907.
‡ *Public Health*, July, 1907.

this small percentage may go on infecting those around them for several years.

In one case it was found that a woman had been passing typhoid bacilli for fifteen years, and had been infecting those around her for all that time. It has been worked out that 20 per cent. of all typhoid cases have typhoid bacilli in their urine after recovery, and that 33 per cent. are still passing typhoid bacilli two weeks after, and 5 per cent. three months after their recovery.

These infected excreta are passed and allowed to remain in some spot where flies have free access to them, or where they rapidly dry in the sun and are scattered by the wind. The particles carried by the flies or the wind are deposited on food articles, milk, etc., and so are a means of spreading infection.

There seems to be little doubt that in a small outbreak at a farm at Beenup the method of spread was some such method as this, and the cause was one of the visitors, who was already in the incubation stage when she arrived at the farm, and showed the early symptoms a day or two before she left.

I should like to remind you of the incubation period of typhoid fever. In investigating an outbreak of this disease the first thing to be inquired is, "Where was this patient ten or fourteen days ago?" If the patient had about that time been visiting another locality, an inspection must also be made of that other locality; and, indeed, attention must be directed primarily to that locality.

If the patient has not been away from home, then the home premises must be inspected and two things especially inquired into, (1) the presence in the house of any person who has within two years had enteric; (2) the dairy from which the milk used in the house was obtained.

These facts about enteric are borne out by the figures for three towns in Germany before and after the introduction of a water carriage system of sewerage:

Death-rates per 1,000 *from Enteric.*

Frankfort	...	Before sewering	0·8
		After „	0·24
Danzig	...	Before „	0·9
		After „	0·18
Munich	...	Before „	2·42
		Partial „	1·33
		Improved „	0·87
		Complete „	0·17

Equally convincing figures might be quoted from the experience of Sydney, N.S.W. In Perth, with the introduction of the sewerage scheme, a similar decline in the death-rate from enteric fever is to be looked for.

It is not to be understood that the water supply and other means of spread are of no importance; all that is desired to-night is to draw your attention more especially to the more important ways of spread.

Diphtheria.

There still remains in the minds of many people the idea that diphtheria comes from bad drains, dirty water, tanks, &c.

Now diphtheria bacilli will not live in water for more than a few hours; on the other hand, when these bacilli are in the form of a dry dust, they will live in the air of a room for three or four weeks; or dry pieces of diphtheritic membrane will live in the air of a room for nine weeks, and are still after that time capable of producing the disease in another person; from this circumstance it is obvious that infection can take place directly from one person to another without any intermediate life in water. The air from drains has never been found to contain diphtheria bacilli, and the only way it can act is by producing a relaxed throat, on which the diphtheria bacillus can grow if it is inhaled; then this effect can only be produced if sewer air is inhaled over a long period.

The reason for any case of diphtheria is then to be sought in contact with some other person who has had the disease, or who has the bacilli in his throat. The existence of carrier cases, *i.e.*, persons who have the bacilli growing in their throats, but have never had the disease, is sufficiently well known.

Again, let me remind you of the incubation period of diphtheria, which is from two days to a week; so that an inquiry as to the movements of the patient for a week previous to the appearance of the disease is necessary.

Milk, in diphtheria as in enteric fever, plays an important part, and an inquiry is necessary as to the dairy from which the family obtains its milk.

GENERAL AND COLONIAL NOTES.

CONCRETE.

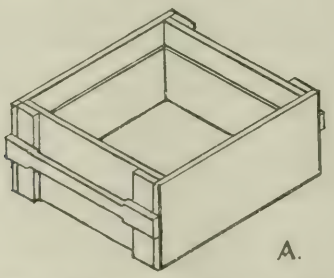
Mixing by Hand.

Concrete should be mixed on a strong wooden platform, firmly fixed together The upper surface should be traversed, if necessary, as it should be quite smooth.

The platform should be at least large enough to permit of two sets of men being employed at the same time: one set to measure and mix, the other set to fill the barrows or other receptacles for transporting the concrete to the place where it is to be used.

The platform should be arranged so that the mixing always takes place in the shade, suitable covering being provided if necessary.

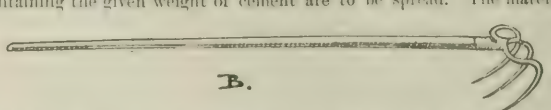
For measuring the aggregate, a bottomless box is to be provided, similar to the one indicated on sketch A; the box to have a depth of 12 inches, the other



A.

dimensions to be determined by the required volume. The box should have a piece of hoop-iron nailed level all round the inside at a height that will give the right proportion of sand to stone or gravel.

The box resting on the platform is to be filled up to the top of the hoop-iron with stone or gravel, then level with the top of the box with sand. The box is to be lifted off, and on the heap of stone or gravel and sand the contents of a bag containing the given weight of cement are to be spread. The materials to



B.

be mixed dry. Twice turning over is generally sufficient if the men are used to the work, but it should be noted that the work of mixing is much facilitated by one man using a rake while the other men are shovelling. The rake should be of the kind indicated by sketch B.

It is essential that the dry mixing should continue until the whole mass of the batch is of a uniform colour.

Water is then added, and the mixing is continued until the mass is again of a uniform colour.

There is no advantage in specifying that the water is to be poured through the rose of a watering pot. In actual work the rose soon gets injured or blocked up, and the men pour the water through the spout of the pot without the rose, and without injuring the concrete. The essential thing is that the materials be thoroughly stirred while the water is being poured.

The quantity of water required for concrete varies within very wide limits. It depends on temperature, on the porosity of the aggregate, and on the dryness of the aggregate.

A good test is to take some of the concrete in the hand and press it tightly together. The water should come out freely on the surface, and on opening the hand the lump should retain its shape. In every case, however, much more water should be used in hot than in cold weather.

It is desirable when concrete is mixed by hand that it should be mixed in small batches at a time.

100 lbs. weight of cement is a very convenient unit for each batch.

Such a batch is more easily manipulated, and the different stages of dry and wet mixing more easily fixed than is the case when large quantities are used.

Machine Mixing.

When the concrete is mixed by machines, it is preferable to use a machine of the paddle type with an open top, because with such a machine the man working it easily controls the different stages during the mixing.

The materials must be as accurately measured before being filled into machines as in hand mixing.

HONG KONG.

His Excellency the Governor, who was accompanied by Lady Lugard, presided at the distribution of certificates of the Hong Kong Branch of The Royal Sanitary Institute, held in the City Hall on February 5th. There were present also Hon. Dr. J. M. Atkinson, President of the Hongkong Branch, Mr. Ralphs, Secretary, Hon. Mr. W. Chatham, Dr. F. Clark, Mr. T. Perkins, Mr. A. H. Ough, and Mr. A. J. Brackenbury. Dr. Atkinson, in opening the proceedings, said:—

Your Excellency, Gentlemen, As chairman of the Board of Examiners I thought it would prove of interest to review the work accomplished by the local branch of The Royal Sanitary Institute since its formation five years ago. The first lecture in connection with this movement was given at Queen's College on the 13th January, 1903. Since then a regular winter course has been held: up to the end of January 209 lectures have been delivered, the attendants at which numbered 3,441, giving an average of 16·46 per lecture. In addition to the lectures many practical demonstrations have been given.

The practical sanitary science examination is intended for those who have no intention of becoming sanitary officers, yet desire to obtain from the Institute a certificate indicating their knowledge of sanitary science. Number of Examinations held, 5; total number of Candidates, 21; total number successful, 10; percentage of passes, 47·61.

Sanitary Inspectors' Examination. With reference to this Examination a practical as well as a theoretical knowledge with the subjects set out in the syllabus is required, and the Local Government Board, London, accept this certificate as evidence that the person possessing it is qualified for the office of Inspector of Nuisances in any urban or rural district outside London; it is also recognised by the Local Government Board, Edinburgh, and the similar institution in Dublin.

In all there have been 39 candidates, 26 of whom were successful, a percentage of 66·6 passes. The number of candidates examined by The Royal Sanitary Institute at London in 1906 is 992; number of passed, 481. 1907 returns are not to hand.* The following officers of the Sanitary Department passed the Examination for Inspector of Nuisances during leave of absence in England: Messrs. L. E. Brett, F. Fisher, E. Allen, and H. J. Knight; so that out of a staff of 30 European Inspectors 19 now hold these diplomas. The Government, in order to encourage the Inspectors obtaining these certificates, refund the fees of the successful candidates; and, next to a knowledge of Chinese Colloquial, in considering the question of promotion from one class to another, priority is given to those who possess the certificate. The local branch is now established in a suitable room at 7, Beaconsfield Arcade, where members can study. It is here that the lectures are given, and we have the nucleus of a library there. Another important fact is that it is now self-supporting. Generally speaking the work of the Institute has been well supported, and the local branch has done good work, judging by the fact that 36 certificates have been gained since the starting of the movement. Mr. Carter is still the life and soul of the branch; he has all along had the interests of the branch at heart and has done all in his power to foster it. Our thanks are due especially to him and also to our local Secretary, Mr. Ralphs.

His Excellency, at the conclusion of the presentation, said—Ladies and gentlemen, it is some years now since certificates which have been won by students of the Hongkong Branch of The Royal Sanitary Institute have been distributed publicly. The last occasion was, I think, in 1904, and on that occasion my predecessor made a long speech, in which he told you generally of the objects of the institution and the work which had been done. The Board was instituted in 1903 on the suggestion of Mr. Carter, and it took shape owing to the energy and organising ability of its president, Dr. Atkinson, and of various other members of the Body of Examiners, many of whom are still on the Board. I think that the value of an institution like this, affiliated to a great institution in England, is immense. The certificates can be obtained here, and are recognised throughout the British Empire, and they can be obtained without the expense of a voyage home and without the cost of tuition in England. They can be obtained in their leisure hours of the evening by the men who are still doing their work and earning their salaries. These are very great advantages. The Hongkong Branch, too, has led the way in adopting that great principle of affiliation with institutions in England, which I think is of immense advantage to the Colonies, and of which I should like myself to see the Colonies take much more advantage. It is the principle which underlies the Oxford Local Examinations which we have in our schools here; it is the

* The figures for 1907 are 1,188 candidates, 592 certificates.

principle upon which the Hongkong College of Medicine intends to frame its future; and it is, as Dr. Atkinson said, the principle which I hope will find still further expression in the Hongkong University of the future. The Sanitary Department of the Government absorbs a great deal of the revenue of the Colony, and consequently has a very considerable staff, and there are architects, builders, and others in the Colony who also require certificated engineers, and the number of these appointments offers inducements to candidates to come and learn, and obtain certificates at this branch of The Royal Sanitary Institute. I think, therefore, that the governing body of the Board of Examiners of the Hongkong Branch may feel that they are rendering a great public benefit to the Colony, and our thanks are most heartily due to the body of gentlemen who give their time and thought gratuitously, without any remuneration, to conducting these lectures day by day on these difficult subjects.

When I look, as I did just now, at this syllabus of lectures, the different themes of the lecturers appear to me to be so practical and so sound that I honestly wish I had the time myself to be admitted and to come and learn some of these things, and endeavour to obtain a certificate (applause). I will not speak now on the necessity of encouraging sanitation in Hongkong: I will not give you a discourse on the lessons to be learned from the great outbreak of plague or of the great value of having an object lesson here in Hongkong for China. All these are great subjects, but they have grown somewhat hackneyed and you have heard them discussed by speakers who have more fluency than I have. I will only refer briefly to the labours of the Sanitary Commission who have spent their private time and laid this Colony under a great debt of gratitude. You have heard, no doubt, a great deal of discussion on their report, and you are likely to hear a great deal more within the next week or two. I will say to these gentlemen I have just had the honour and pleasure of presenting with these certificates, that in their greater wealth of sanitary knowledge they should not lose sight of the saving grace of common sense. I think that sensible toleration is the most valuable sense a man can have; our ideals are good, but not always easy to realise. By the exercise of common sense, tact, a little give and take, men may often achieve results that are more valuable than all the rules of the text books. You may obtain these results without wounding the prejudices of others. It is your business here to endeavour to impress upon the Chinese community the value of sanitation, and to try to get them to work with us, and not against us. We wish to make the Chinese gentlemen of intelligence and standing co-operate with us in our work of sanitation. We wish to get them to show us the right way to put a stop, for instance, to the abandoning of bodies in our public streets. I had, a day or two ago, a return made of the number of bodies abandoned within the 13 preceding days. The number was 38, and out of that about one half had died of infectious diseases. That is a standing reproach to this Colony, and I am convinced we shall never succeed in putting a stop to it until we get the co-operation of the Chinese, and get them to show us how we can stop this thing without wounding their prejudices and violating the sanctity of domestic life. That is why I say to you that I hope those who have gained all the technical knowledge which is represented by these certificates will bear in mind that a very great deal can be done by tact and common sense in their dealings with those on whom they have to impress the primary laws of sanitation.

TASMANIA.

A very complete course of Instruction has been arranged at the Technical School in Hobart Town, Tasmania, for the preparation of candidates for the local Examinations of The Royal Sanitary Institute. The course consists of twenty-four lectures, covering all the subjects that come within the duties of an Inspector. Following each lecture as closely as possible a practical demonstration or visit is arranged, to illustrate the carrying out in practice of the work or duties to which the subject of the lecture is related. The lecturers are Dr. Elkington, the Chief Health Officer; Dr. T. Gregory Sprott, the Port Health Officer; Mr. Allan Walker, Architect, who are members of the Board of Examiners; and Mr. Wadsworth. The course occupies seven months, and towards the end there is a practice Examination as a preliminary to the Examination of the Institute, which is arranged to be held in Tasmania in October.

WESTERN AUSTRALIA.

The Institute's Board of Examiners for Western Australia arranged an extensive Course of Lectures at the Technical Schools, Perth. The Course was divided into four parts, suitable for the several examinations held by The Royal Sanitary Institute.

Part I. On Hygiene and Sanitation, consisting of 24 Lectures.
Part II. On Meat and Food Inspection, consisting of 24 Lectures.
Part III. In Sanitary Science, consisting of 24 Lectures.
Part IV. In General Hygiene and Sanitation, for members of Local Boards of Health, Schoolmasters, Secretaries of Local Boards, and others interested. This Part consists of 12 Lectures.

The various parts ran concurrently; the whole Course covering a period of six months. Arrangements were made for practical demonstrations and inspections of various works, and the Board are to be congratulated on the comprehensive syllabus drawn up.

NOTES ON LEGISLATION AND LAW CASES.

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For full text of these see Law Reports, which can be referred to in the Library of the Institute.

LANDLORD AND TENANT.—*Insanitary house—Claim by wife and children for damages for typhoid fever caused by defective drains.*

The House affirmed the decision of the First Division of the Ct. of Sess., (1908) Sess. Cas. 475, and dismissed the appeal, holding that the appellants—the wife and children of the tenant not being parties to the contract of lease—had no claim for damages.

Cameron v Young. H.L. (Sc.) (1908) W.N. 61.

SEWERS.—*Damage caused by exercise of statutory powers—Public Health Act, 1875 (38 & 39 Vict. c. 55), s. 308—Sewers.*

The respondents, acting under powers conferred by the Public Health Act, 1875, constructed an intercepting sewer, a pumping station, a sewage reservoir, and an outfall sewer, which were integral parts of, and together formed, one scheme of sewerage. The sewers were in part constructed on land the property of the claimant; the pumping station and the reservoir were constructed on land the property of other persons. The present value of certain portions of the claimant's land which were in proximity to the pumping station and reservoir was depreciated by reason of the contemplated user of that station and reservoir for sewage purposes:—

Held, that as the acts of user, the contemplation of which caused the depreciation, would be done on land not the property of the claimant, the damage was not sustained "by reason of the exercise of the powers" of the Public Health Act within the meaning of s. 308 of that Act, and consequently that the claimant was not entitled to any compensation under that Act in respect of that depreciation.

Judgment of Bigham J., (1907) 1 K.B. 14, affirmed.

Horton v. Colwyn Bay and Colwyn Urban District Council. C.A. 327. 1 K.B. March 1908.

SEWERS.—*Adjoining Houses—Single Private Drain—Entry by Local Authority upon Ground of one House—Examination of Drain—Notice to Occupier of Adjoining House—Recovery of apportioned Part of Expenses in relaying Drain—Public Health Act, 1875 (38 & 39 Vict. c. 55), s. 41.*

The drainage of two adjoining houses was carried into a public sewer by a single private drain. The sanitary inspector of the appellants (the local authority), on the application of the occupier of one of the houses, applied the smoke test to the drains of that house and found that something was wrong. The appellants subsequently served a notice on the respondent, the owner of the adjoining house, requiring him, in conjunction with the owners of the house where the smoke test had been applied, to take up and relay the drain within one month. The work not having been done, the appellants did it, and apportioned the costs in respect of the respondent's house at £23 9s. 2d. The appellants had given no notice under the first part of s. 41 of the Public Health Act, 1875, to the occupier of the respondent's house of their intention to enter the house where they applied the smoke test and examine the drain, and no evidence of emergency was given. The respondent did not pay the £23 9s. 2d.

On a complaint preferred by the appellants against the respondent that the £23 9s. 2d. had not been paid:—

Held, that the twenty-four hours' notice to the occupier of the respondent's house of the intention of the appellants to enter the house where the smoke

test was applied and examine the drain was not a condition precedent to the right of the appellants to recover the apportioned expenses from the respondent, inasmuch as the object of the twenty-four hours' notice required by the first part of s. 41 of the Public Health Act, 1875, is to enable the surveyor to enter when his entry, but for that notice, would be a trespass. The notice is not to enable the owner, who might ultimately be liable, to come and see the result of opening the drain, inasmuch as it is not to the owner it has to be given, but to the occupier.

Bromley Corporation v. Cheshire. Div. Ct. 680. 1 K.B., April, 1908.

SEWERS.—*Drain or Sewer—Nuisance—"Intimation" Notice—Service on person not liable—Compulsion—Recovery of expense of abating nuisance.*

A nuisance having arisen from the obstruction of a pipe which carried off the drainage from the plaintiffs' premises, the defendants' sanitary inspector served on the plaintiffs an "intimation" notice under the Public Health (London) Act, 1891, requiring them to abate the nuisance. The plaintiffs contended, and it was the fact, that the pipe was a sewer, and therefore repairable, not by them, but by the defendants; but the plaintiffs did the work necessary to abate the nuisance under protest, and sued the defendants to recover the expense incurred by them under compulsion which the defendants were compellable to pay:

Held, that the plaintiffs were entitled to recover.

Oliver v. Camberwell Borough Council, (1904) 68 J.P. 165, distinguished.

Wilson's Music & General Printing Co. v. Finsbury Borough Council, Channel, J. (1908) 1 K.B. April 1908. 563.

WATER.—*Mines—Support—Waterworks—Workings within 40 yards—Workings outside 40 yards—Waterworks Clauses Act, 1847 (10 & 11 Vict. c. 17).*

The House affirmed the decision of the C.A., (1906) 2 Ch. 564, holding that the appellants ought to be restrained from mining so as to damage the respondents' land, of which the latter owned the surface only, within a belt of 40 yards, also the land of which the respondents owned both the surface and the minerals outside a belt of 40 yards.

New Moss Colliery, Ltd., v. Manchester Corporation. H.L. (E) (1908) W.N. 61.

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THE INSPECTION OF DAIRIES AND COWSHEDS.

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I ASSUME that there is nothing to be said about inspection apart from the character and conditions of the matters or things inspected. My subject is therefore really "Conditions in Dairies and Cowsheds which we seek to obtain by Inspection."

In the course of my duties I have been inspecting cowsheds for thirteen years; and have about eight hundred in my districts. Thirteen years ago, although the Dairies Order (1885 and 1886) had been passed, regulations had not been made. I can therefore trace improvements from the commencement of the work of inspection; and with sufficient material for my paper within my own experience, I propose to confine myself within its limits.

I must mention here the risk which an inspector runs if he is bold enough to interfere with the property of a member of the Sanitary authority which he serves. I myself was refused re-appointment by a rural district council because I proposed to carry out cowshed inspection. It is nine years ago, and can be referred to now without personal bitterness; but I have never since lost an opportunity of advocating the great desirability of security of tenure (during efficiency and good behaviour of course understood) for all officers who are at present subject to periodical re-appointment, and so are at the mercy of interested and hostile individuals.

I have no experience of cowsheds in large towns. Mine are all in country districts, and the cows are turned out for four, five, or six months

in the year, and probably for watering also twice a day during even the winter months. On the bleak hillsides of Biddulph strong winds blow, and occupiers assure me that their problem is to prevent excess of "ventilation." The cowsheds also range from stone or brick-built sheds, more or less lighted, ventilated, and drained, with a capacity of from six to fifty cows, to wooden or galvanized iron structures, often without those features, and with a capacity for one, two, or three cows. I find it impossible therefore to dogmatise, even as to minimum requirements, and am accustomed to treat each case on its merits.

The Dairies Order requires registration of all milk-sellers, with certain specified exemptions. There is a very prevalent idea that this exemption extends to all the requirements of the Order. In my largest district this view has been held; and I can show two contiguous farms, on one of which the cowsheds are inspected and are being gradually improved, because the occupier sells his milk; on the other nothing is done because the occupier makes butter and cheese, and does not sell his milk as such. And this is not a solitary instance, but is of common occurrence. There is evidently a screw loose here. There is no guarantee that a man who makes butter or cheese at one time may not sell milk at another; or, at all events, that if one tenant makes butter or cheese, a succeeding tenant may not sell milk. There is also another important consideration: on country farms a certain amount of young stock is reared, and sometimes the accommodation for it is very unsatisfactory; yet, because it is not milk-producing, it is held to be outside our power of interference. It is hardly necessary to point out that seeds of disease may thus be early sown, and may affect the health of the animals when they reach the reproductive and milk-yielding age. Eight years ago we asked the Local Government Board for a ruling on this point. We were informed in reply that it was not the function of the Local Government Board to interpret the Order; and a very guarded opinion was given, as I read the letter, that the exemption was limited to registration; but in spite of this, my Authority accepted the view of some of its members that the Order was intended for the protection of the public milk supply, and therefore could have no reference to any animals or their conditions of housing, which did not contribute to such milk supply. I am a paid servant and subject to annual re-appointment. With my experience of the loss of one appointment, can you expect me to quarrel with another authority over the interpretation of a clause in the Dairies Order, on which the Local Government Board itself declines to give an authoritative ruling?

The Order requires the lighting, ventilation, air-space, cleansing, drainage, and water supply to be such as are necessary or proper for the health of the cattle, the cleanliness of the vessels, and the protection of the milk.

1. Lighting. What is efficient lighting? I suggest, such as enables every part of the shed to be inspected without difficulty. Some authorities say one-thirtieth of the floor space, which would frequently mean rather less than two square feet per cow. Other authorities ask for three square feet per cow. My experience is that a great deal depends on the position of the windows, and the kind of glass of which they are made. I know a shed which is insufficiently lighted, though with a theoretically good window area, because all the windows are in one wall behind the cows, and the glass is not clear. I know another which is well lighted, though with smaller window area, because half the windows are in the roof, and all are of clear glass.

Many farmers have inherited an idea that cows give more milk if kept in the dark; hence the common experience of old cowsheds without any windows at all, and the difficulty of inducing the occupier to join in a demand for light addressed to the owner.

2. Ventilation; and 3, Air space. These must be considered together, because they are interdependent. The more perfect the ventilation, the less (of course, within limits) need be the cubic capacity.

An old shed will have no inlet ventilator save the top half of the door, and, unless by accident, no outlet. The first ventilator invented was the inlet made by omitting a brick, or bricks, from the wall. These apertures will always be found stuffed with hay. The next was the "hit-and-miss" wooden shutter. This will be found caked up with dust and cobwebs, showing that it is not used. The next is a small fraction of a window swinging on a central pivot. Even these are not freely used, because the lower aperture admits a stream of cold air directly on to the cows' hindquarters. This defect is capable of easy remedy. If the pivot be removed and hinges substituted at the bottom of the movable sash, allowing the upper part to fall inwards (from 30° to 45°), and a triangular board be fixed at each side, the whole of the incoming air will be directed upwards, and will not strike upon the cattle. This may seem a trivial point, but it is so important in the cowshed that it often makes the difference between the willingness or unwillingness of the farmer to allow his windows to be opened.

I am not satisfied with any of these devices. It is necessary to have independent inlet ventilators permanently open. The best plan is to bring

the roof, on the rafters, just over and beyond the outside walls, and to leave the space permanently open where the rafters rest upon the wall-plate, or wall. Another good plan is to insert a sufficient number of common drain-tiles through the walls, with of course an upward slant from without inwards.

But it will be found, with any of these plans, that ventilation is not effected unless there be also adequate outlet ventilators. These are best formed by louvred shafts projecting above the ridge of the roof. If there be a hay-store over the cowshed (as there nearly always is in old buildings), a wooden shaft must be built between the ceiling of the cowshed and the roof of the building. It is also true conversely that outlet shafts will not secure ventilation unless there be inlets. This is apparently a small point, but of great importance.

I went to measure a shed a fortnight ago, for the purposes of this paper. It has standings for 36 cows in two rows. It is 62 feet long by 34 broad, or 2,108 square feet (58·5 square feet per cow), and the height varies from 8 feet 6 inches at the eaves to 16 feet at the ridge, giving about 700 cubic feet per cow. Two opposite doors and four windows were open, and yet ventilation was imperfect. There were no outlets. Another shed recently visited has good outlet shafts, but no inlets except door and windows. When these have been closed during a night, the condition of the shed in the early morning is simply lamentable, in spite of free outlets.

I am not going to pin myself down to figures, so much depends on the situation of the shed and its accessibility to the prevailing winds: but in the open country 600 cubic ft. per cow is ample, if the ventilation be right. More simply lowers temperature without increasing purity: and I believe it is a fact accepted by many authorities that a temperature of 58° to 60° is desirable, although, on the other hand, it has been recently stated that cows give more milk when turned out a part of the day all through the winter.

Theoretical calculations have given from 25 up to 54 square inches per cow as the necessary area of the inlets. I do not myself attach much importance to these arithmetical exercises. An officer of the Local Government Board informs me that 115 square inches per standing was the actual result obtained from measurements of about 100 sheds in various parts of the country.

4. Cleansing. This is a difficulty. It includes the free use of water and the structure of the shed, which will be considered separately: the use of the curry-comb and brush, which very few farmers in my district

are willing to admit; and washing the udders and teats, which no farmer, so far as I know, has yet arrived at. It includes the steaming, or other effectual cleansing, of all the milk-cans and vessels, the cleanliness of the milk-store, the protection of the stored milk from dust, and the prohibition of the use of the milk-store for other purposes, such as a larder, a scullery, or a washhouse. The smaller the establishment the more faults are found. The worst is the case of the cottager keeping a single cow, with nobody to look after it but the wife in the intervals of other duties, or a child during the hours not spent at school. The better conditions are found on the larger farms, because hands will be employed for this special duty, and the quantity of milk to be dealt with will necessitate, for simple commercial reasons, the provision of sufficient apparatus and conveniences.

Cleansing also includes lime-washing; on which there are two points to note. Many people limewash in May and October, and no more. The walls get into a condition of filth which is indescribable, and remain so from November to May. This applies mainly to sheds with insufficient depth behind the cattle, and these are very common. Some people use tar instead of lime, for a height of 3 to 4 feet from the floor. This is a mere attempt to conceal the dirty state of the wall, and should be forbidden.

5. Drainage. This also is commonly a difficulty. No sewers are available, and the drains are primitive. Sometimes they lead, more or less directly, to the pit from which the cattle drink. In any case the drainage has to be disposed of on the premises; and the results are scarcely ever satisfactory. It is difficult enough to obtain drainage, satisfactory to a modest scale of requirement, in the case of an isolated country mansion; it is hopeless to expect it for a cowshed. I do not mean that it is impossible so design it, or to carry it out; but that it is difficult to get a country authority to insist upon it.

The Dairies Order is adoptive only; and even when it has been adopted, there is nothing to compel an authority to enforce it. An officer serving an unwilling authority is helpless. If the milk supply is to be really safeguarded, it would appear necessary to have some superior authority, able to put pressure on the local authority.

Large towns like Manchester and Liverpool have obtained various additional powers in their private Acts. Thus they can follow up a sample of tuberculous milk to the farm which supplied it, however distant: they can examine the cattle, and find the diseased animal; and they can compel the farmer to comply with their requirements, on pain of having

his milk supply prohibited. More has been done in this way, indirectly, to convince the farmer that cleanliness will pay, than by any direct action by local authorities.

6. Water supply. This is perhaps the most important detail; it is certainly the most difficult to deal with. The cattle have to be turned out to drink at a pond or ditch possibly sewage-polluted. If a pure water supply does not exist on the farm (for often the well which supplies the house is not above suspicion), and no public supply is within reach, it is beyond my power to suggest a solution of the difficulty. I have one farm where rain-water is stored in large tanks which feed a small cistern fitted with a ball-tap which automatically supplies a small drinking trough in each standing; this is the only case I know, and even here there are doubts as to the quality of the stored rain-water, collected as it is off dirty roofs. One authority has stated that it "does not matter much" about the water that cows drink, if only that is pure in which the milk vessels are washed. As to water for swilling, whose purity does not matter, even here the supply may be insufficient. Certainly the majority of cow-keepers are sparing in their use of it. That the water supply should be both abundant and good is a prime requirement. I know few farms where it is fulfilled.

In conclusion, I will briefly glance at the construction and arrangement of a cowshed. A cow requires about 8 feet of standing room, of which 2 feet, at the front, ordinarily contain the feeding trough. In front of this there should be a passage, which serves both for ventilation, and for the convenience of the attendant in feeding; this should be 4 feet wide, though a little less would do. At the heels of the cow should be a manure trench, 2 feet wide; and behind that at least 5 feet more of distance to the wall. This makes a total of 19 feet in depth, which may seem excessive, and which I grant is rarely obtained, but it is the minimum which will secure cleanliness. I know sheds which are only $10\frac{1}{2}$ to 12 feet in depth; they are always the dirtiest and most unsatisfactory; and, in fact, impossible to keep clean. A word may be given to the floor. Avoid interstices, and get a smooth surface that can be easily swilled and brushed; but do not make it so smooth that the cows fail to get foot-hold, fall, and damage themselves (I have heard of a broken leg). The best surface is concrete, but without the finish in cement.

Notices under the Dairies Order can only be served on the occupier. This is an important defect in practice; and it would be better if we could deal directly with the owner, who, of course, is the person responsible for structural alterations.

I have recently considered the possibility of taking action under the Nuisance Clause (91 [3]) of the Public Health Act, 1875, but there seems to be an unwillingness, or inability, on the part of everyone whom I have consulted to show me what evidence would be sufficient to convince a bench of magistrates that any cows were so kept as to be a "nuisance"; and I shall be very grateful to any of my more experienced confrères who can solve this difficulty for me.

Since writing the above I have been shown a similar paper by Dr. J. H. Garrett, Medical Officer of Health of Cheltenham (*Sanitary Record*, April 2nd, 1908) with whose conclusions I am in general agreement. Summarised, they are:—

1. Yard surface to be hard, dry, and clean; no manure within 45 feet of shed.
2. 800 cubic feet space; 144 square inches of inlet, and same of outlet, ventilation per cow.
3. Window area one-thirtieth of floor.
4. Floor to be evenly paved, channeled, and drained.
5. "Sufficient and suitable supply of water" *must* be provided.
6. Manure to be removed frequently; floor to be swilled twice a day.
7. Limewashing twice at least during time sheds are in use.
8. Milk-vessels to be cleansed.
9. Milker to be clean.
10. Cow to be clean.

I would add, as I have previously said:—

a. Security of tenure of office for inspector.
b. Power to county council (or other body) to keep smaller authorities up to the mark.
c. Authoritative extension of the provisions of the Order to all cowsheds; and Order to be made of universal application.
d. At least 5 feet of space (called the "milking-passage") behind the manure channel in a shed.
e. Notices to be served direct on the owner.

The reader then exhibited a dozen sets of plans of cowsheds, and alterations and improvements in old sheds, as carried out within the last eight years.

Dr. James Wheatley (Salop C.C.) said that they no doubt all agreed as to the absolute necessity of obtaining clean milk from healthy cows. The last report of the Royal Commission demonstrated clearly the danger of milk from tuberculous cows, although he did not think it gave them the means of estimating

the proportion of tuberculosis spread in that way. But, although they were agreed as to the necessity of obtaining a pure milk supply, there would no doubt be differences of opinion upon the details of procedure and the requirements that should be enforced.

In attacking this problem of the production of pure milk, they must proceed along two lines: the inspection of dairies and cowsheds and cows on the one hand, and the education of those engaged in the trade on the other. Neither of those courses without the other would be at all effectual, for carelessness or ignorance amongst those handling the milk might in a moment undo the good that had been brought about by the better construction and cleanliness of the sheds. The persons who undertake the collection and distribution of milk must be brought to understand that upon their care and intelligence depend the lives of their fellows, just as a chemist does when handling poisons. Probably the principal part of this education would have to be carried out by sanitary officials, but he thought the soil might well be better prepared by education authorities. He considered that Dr. Garstang showed in his paper that education was more difficult than inspection. Undoubtedly the principal difficulties arose from the constitution of the supervising authorities and the methods of appointment of the officials. It appeared to him so clear as to hardly require stating "that the supervision of the conditions under which a food is produced could not with safety be left in the hands of the producer." The peculiarity of the milk trade was that the large consumers, *i.e.*, the large centres of population, had little or no control over the conditions under which milk was produced. That was the difficulty that the Government was faced with, and it was safe to assume that in the long run no scheme would be really successful, unless the consumers could directly or indirectly bring pressure to bear so as to enforce efficient inspection.

He had no hesitation in saying that in a large proportion of rural districts the inspection of dairies and cowsheds did not exist, or failed to attain its object.

There was one aspect of this question of the provision of a pure milk supply which he would like to bring forward, the possibility of keeping cattle entirely in the open air. If it were possible to keep cattle in the open for the whole year, he thought we should have a clean milk supply, and that with other simple precautions tuberculosis would rapidly disappear.

He had been greatly struck with the absence of dirt in the milk in some parts of the West of Ireland, due entirely to the fact that the cows were kept in the fields and milked there. The hind quarters and udders of a cow so kept were clean, and there was no dust and dirt of the cowshed to get into the milk.

As bearing upon this subject, he wished to draw attention to some experiments made in the years 1901–1904 at Harper-Adams College, Newport, Salop. Those experiments were perhaps well known in the agricultural world, but they had not been considered sufficiently from a public health point of view. For the purpose of the experiments two lots of cows were selected, as closely alike as possible in all respects. One of these lots was brought into the sheds each night,

commencing about the end of October or beginning of November. That was the usual practice in the locality. The other was kept out about a month later. The actual dates at which the experiments finished were: in 1901, Dec. 7th; 1902, Dec. 13th; 1903, Nov. 28th; and 1904, Dec. 31st. Without going into details, but taking the average results, the cows that were kept out at night gave more and richer cream, and gained more in weight than those that were brought in. The report says: "The results for the four years are decidedly in favour of leaving the animals out at pasture during the night, and from the fact that there is a greater increase in live weight where the animals are turned out it is apparent that they do not suffer by the treatment. Observations were made on the animals on very cold nights, and they were found lying down close to the homestead. No shelters were available for the animals, and they did not appear to seek shelter from the hedges."

He had had an opportunity of discussing that report with the Principal of the College, who said that the cows kept in the open were in decidedly better condition, and their coats thicker than those that were housed. The experiments might easily have been carried out throughout the whole year so far as climatic conditions were concerned, but there were undoubtedly difficulties of management.

These experiments, if confirmed by others, appeared to him entirely to dispose of the idea that a warm, and if warm necessarily ill-ventilated, cowshed was essential for the free production of milk. Probably buildings of a much less expensive character and much more open to the air were all that were necessary. If, on the other hand, it could be shown that the difficulties of management could be got over, and that cows could be kept altogether in the open, the problem of a pure milk supply was practically solved.

It must be remembered, too, that the danger from dirty milk was principally during the hot summer weather, when milking in the open should be comparatively simple.

As bearing on that point the following extract was read from a letter received from a land agent in the Midlands:—

"In answering your questions with reference to the open air housing of milk cows, I must ask you to understand that I can only do so from a general standpoint. I have no carefully compiled statistics to support my views, and care should be taken to found no definite statement upon them.

"This question, from the point of view of health, is of enormous importance, and I have always felt that experiments in connection with it should be undertaken and extended over a long period by every Agricultural College in the country. So far as I know the Harper-Adams College is the only one which has given any attention to the matter whatever.

"I will take the questions as they come in your letter.

"(1) The cattle are kept out in the fields day and night, without any form of shelter beyond that which is provided by the hedgerows.

"(2) They are brought in for milking morning and afternoon, and in winter for feeding as well; that is to say, the feeding and milking go on simultaneously.

"(3) I do not think that either the quantity or quality of the milk has been appreciably affected. The Harper-Adams College experiments go to show that open air housing increases the supply.

"(4) The general health of the animals has improved: (*a*) No tuberculosis exists in the herd so far as I know. (The cows have never been tested, but a rigorous winter would soon discover the presence of the disease): (*b*) The general improvement in health would naturally imply greater hardness.

"(5) More liberal rations are necessary to make up for the greater waste going on in the animal's body in cold weather, and therefore the cost of feeding would be somewhat higher.

"There are two drawbacks to the system, and one of them is very serious. During a wet winter or spring the surface of the land is much trodden and poached, considerably to the detriment of the herbage in the following summer. This of course would apply with greater force to badly drained low lying land, but nearly all kinds of land would suffer more or less.

"Then the cows do not distribute the manure so uniformly as the farmer would do. They leave it for the most part in the sheltered spots, that is all round the hedges; and it is impossible to collect it and spread it elsewhere before the virtue has been washed out of it."

Dr. Wheatley agreed with most of the suggestions made in Dr. Garstang's most practical and useful paper; but he could not agree that 600 cubic feet of space would meet the physiological requirements, unless the ventilation were of such a character that the cowshed was practically an open shelter. With a reasonable height, say 10 feet, it was difficult to obtain sufficient floor space for cleanliness if the cubic space was much under 800 cubic feet.

Dr. M. Gepp (Shrewsbury) said Dr. Garstang proposed glass windows, but in a case which had come under his notice, the Local Government Board did not appear to consider that glass could be enforced. The owner of a cowshed refused to have glass, and said he would rather shut up the shed. On the question being referred to the Local Government Board, they replied that they had no jurisdiction, but they were advised that framed openings, whether glazed or not, would be sufficient for securing the cowshed to be properly lighted. An important point, it seemed to him, was the inspection of cattle as well as the inspection of cowsheds. That was a matter of grave difficulty; inspection of cattle meant veterinary inspection, and small councils would not, in his experience, appoint veterinary inspectors. In an urban district he served they, some years ago, had a veterinary inspector who took a great interest in tuberculosis, and who went round the cowsheds and inspected the cattle, and reported that a considerable portion of the cattle were tuberculous. He advised that there should be periodical and regular inspection of the cattle. Then the difficulty cropped up that this urban district was supplied mainly by milk from cows kept outside the district. The urban district found it had no

jurisdiction, and could not send its inspector out to the country districts to inspect the cattle. Then an effort was made to secure joint action with the rural districts, but these did not feel inclined to incur the expense, and the whole thing dropped through. It seemed to him that the only remedy was that the County Council should have supervisory powers, and that under such powers they should appoint, or employ, a veterinary surgeon as chief inspector of cowsheds.

Prof. W. T. Wilson, (Harper-Adams Agricultural College, Newport), pointed out a difficulty in keeping the concrete flooring of country cowsheds perfectly clean without a convenient water supply, thus rendering the surface so slippery from manure as to be very dangerous to in-calf cows; yet this difficulty could be considerably minimised by the use of Gypsum sprinkled over the flooring after sweeping, or sprayed with a solution about the consistency of thin lime-wash, which agent further acted as a deodoriser.

If the space recommended by Dr. Garstang behind each cow were necessary, it would necessitate practically all the cowsheds throughout the country being remodelled. He was pleased to hear the remarks made by Dr. Wheatley in reference to the education of the persons occupied in the handling of milk: this point should be very strongly emphasised, as people were perfectly reckless in the majority of instances in the clothes they wore, the dirty aprons and smocks they put on, the filthy condition of their hands, and the repulsive habit of spitting to moisten their fingers prior to milking, nor should odd men on the farm, who may have been previously engaged in various work, be permitted to assist in the milking in emergencies.

For such conditions it was nearly impossible for the farmer to be held responsible, as the milkers were accustomed to these methods: the sanitary improvements must be brought about by the education of the younger generation, which could be imparted in the rural schools. Further, farmers should be bound to pay more attention than at present to the state of health of the milkers, and in case of any infectious illness in them, or their family, to notify the authorities at once.

His college had carried out a series of experiments (1901–1904) in keeping milking cows in the open during the winter, and the results were decidedly in favour of leaving the animals out at pasture during the night; further there was a greater increase in live weight, pointing to the fact that they do not suffer by the treatment, and there were no shelters available for the animals.

The drawbacks, however, contained in the letter read by Dr. Wheatley did not occur particularly in their experiments: their main difficulties were, that on their wet land the pasture became much trodden up, which would not be so liable to occur on dry pasture lands, and also that the cows having been accustomed to pass through certain gates at milking times, would congregate there, necessitating a thorough cleansing of the udders, etc., prior to milking.

which in the winter with the dark cold mornings became a trouble, possibly a point which most dairy farmers would be inclined to overlook; but the practice of milking the cows in the field during the summer is strongly recommended by one of the chief British milk companies, and there was no doubt cows could be so accustomed to be milked in the open all the year round.

Dr. Herbert Jones (Hereford) considered that the subject was being discussed at a specially opportune moment, for it was an open secret that the Local Government Board were drafting a Bill having for its object the consolidation of the existing enactments which controlled the milk supply of England and Wales. He could not refrain from referring to the catastrophe which happened to Dr. Garstang nine years ago, and which was no less a catastrophe to the rural district council which resented the conscientious and thorough manner in which he was carrying out his duties. For the past thirty years sanitary officials had been complaining of the grotesque position they were placed in owing to the system of short term appointments, and if it had not been for the action of the Northwich Rural District Council, and of many other sanitary authorities, the task of removing the injustices complained of would have been almost insurmountable. During the past seven or eight years attention had been drawn in season and out of season to the question of lapsing appointments, and there appeared at last to be some chance of their efforts being successful. He considered that if the provisions of the Dairies, Cowsheds, and Milkshops Order had been enforced as they ought to have been the present outcry against the conditions under which the milk trade was carried on would not have been possible. The 1885 Order required that a dairy or cowshed should not be occupied until the sanitary authority was reasonably satisfied that the lighting, ventilation, drainage, means of cleansing, and the water supply were adequate, and such as were necessary for the health of the cattle, for the cleanliness of the milk vessels, and for the protection of the milk against infection and contamination. There were other provisions dealing with infection and with the proximity of privies or water closets to dairies, so that even without the adoption of regulations under the Orders a great deal could be done in the way of improving existing conditions. One of the most gratifying features connected with the improvement of the milk supply was the frank acknowledgment of the most enlightened dairy farmers themselves that improvements were necessary. That there was very little difference of opinion between medical officers of health and the dairy farmers as to what was required was shown from the following recommendations which were made at a conference between the Central and Associated Chambers of Agriculture and the County Councils Association.

"That legislative steps should be taken to secure the adequate (*a*) lighting, (*b*) ventilation, (*c*) cleansing, (*d*) drainage, (*e*) water supply, of cowsheds in both urban and rural districts.

"That every local authority should only register such premises as they may

deem suitable, and when the premises to be occupied as a dairy or cowshed should have been made to satisfy their requirements.

"That all premises occupied for the purpose of milk selling within the meaning of the Dairies, Cowsheds and Milkshops Orders should be inspected by the inspector to the local authority not less than twice in each year.

"That all cattle used for the purpose of milk selling should be examined (especially for tuberculosis of the udder) by duly qualified veterinary surgeons appointed by the local authority not less than twice in each year.

"That if the owner of a cow had reason to suspect that the cow was suffering from tuberculosis of the udder, he should be obliged to isolate the same and to give notice to the local authority.

"That it should be the duty of the local authorities to examine the milk in the various dairies in their district, and to prevent the supply of milk from cows with tuberculosis of the udder and of milk containing matter rendering it unwholesome or unfit for the food of man.

"That if the local authorities did not properly and efficiently exercise their powers, provision should be made whereby either the Local Government Board, or the Board of Agriculture and Fisheries, could appoint some person or persons to carry out those powers at the expense of the local authority."

When we compare these recommendations with those advocated by sanitary officials we might safely look forward to a time very near at hand when the opposition which was now experienced in some places at the hands of the farmers would be replaced by cordial assistance and support, and when a milk dealer would feel it a positive disgrace to send out milk which was not absolutely pure and clean.

Dr. R. Beresford (Oswestry), referring to ventilation, said his idea was that if they raised the roof sufficiently from the walls they would get natural ventilation. Farmers were often willing to do all they could, but in many cases the sheds were very old, and it would be a great difficulty and expense to convert them to the kind of thing Dr. Garstang wanted. The chemical action of light was a wonderful thing, and that had much to do with the prevention of tuberculosis. At one time he used to think the only way of dealing with the milk difficulty was to take the bull by the horns and abolish the cow, but he thought now that with sanitary science, medical officers of health, and inspectors of nuisances they would be able to avoid the abolition of the cow.

Dr. Robertson (Birmingham) wrote:—He had been concerned recently in surveying our position as regards the production of milk free from tuberculosis, and as to the possibility of greatly reducing the loss to farmers and butchers arising from this disease.

Given reasonably good structural condition of the buildings, there did not seem to be any great difficulty in freeing a herd of cattle from tuberculosis

at a relatively small cost. This had been done in England, and it was done in Denmark. The saving to the farming class must be a substantial one. The stamping out of tuberculosis carried with it a careful scrutiny of the cattle and hygienic conditions of the cowshed.

One of the greatest stumbling blocks in the direction of improving the condition of the cowsheds was the fact that many of them required to be demolished and rebuilt, while others required considerable structural alterations.

He believed the only way to get this necessary preliminary reform carried out was for the Government to grant short loans to the land owners. In many parts of the country land was already so unremunerative as to make it impossible from a business point of view for the owner to do what was necessary. Such loans, repayable during a short period of years, would be a great inducement, and would not necessarily mean any loss to the country as a whole.

Mr. J. Pinches (Lichfield) said that the floor space should be definitely stated in the regulations, not merely by mentioning a certain number of square feet per cow, but also how that number should be divided. It was important that the width should be defined, because some officials had caused them to construe a minimum floor space of fifty square feet into meaning a standing space of 10×5. Common sense would show that a width of five feet allowed the cow's head and tail to be at the manger at the same time, and made cleanly conditions impossible. It showed the fallacy of making regulations indefinite. He had intended asking Dr. Garstang what width he recommended, but calculating from some dimensions given on pages 248 and 250 of the paper, it worked out, roughly, at $3\frac{1}{2}$ feet per cow.

Samuel Greenway (Tarporley) thought a great deal had been said about educating the farmer to be more clean, to exercise greater care in milking and in handling milk, that in all cases cows' udders ought to be washed, and the milkers appear in clean milking gowns. He was as strong a believer as any one in scrupulous cleanliness, both in person, habits, and vessels; and could testify that many farmers and dairymen in his district exercised that care, and milking gowns were provided. There were of course others who told you that at present prices such superfluities as white milking gowns could not be provided, as much of the milk in the winter months was produced at a loss. Therefore it was a question of money, and the public would require to be educated to pay a higher price for dairy produce.

Nothing had been said with regard to wet or dry milking. Women were by far the cleanest and best milkers, but farmers declared that it was becoming more difficult year by year to secure women servants and milkers, and in some places on large farms Irish labourers had to be depended on for milking. They were the dirtiest milkers, and nearly always were wet milkers; that was a dirty habit and should be prohibited by law, as there was no need for it, and cows would

give their milk just as well with dry milking, which was far cleaner. The washing of cows' udders or teats had a tendency to cause them to chap or crack and to become sore, but as most of the sand or dirt found on cows' udders was dry, it ought to be well cleaned or rubbed off with a dry cloth before milking.

Then some of the speakers had advocated keeping cows out in the open all the year round. In his opinion there were strong objections to this course being adopted. It would be impossible on much of the clay and meadow land of Cheshire and the North of England for the following reasons :—I. Much of the best grazing land was tender on the surface with a clay subsoil, and during the winter months would become so trodden up with a stock of milking cows as to be unfit for cattle to be upon. The continuous trampling would ruin such grazing land for the following year, as it would destroy the finer grasses and clovers which make up the richest pastures. II. Many of the farmers had large quantities of straw and litter that was unsaleable, or which they were not allowed to sell, and they required this to be converted into manure. III. There would be great danger of cows in heavy milk contracting gargle or inflammation in their udders. IV. There was also the difficulty of securing servants or men who would go out in the depth of winter to either bring in the stock or milk them outside. For those and other reasons he did not think it possible to keep milking cows out all the year round.

THE PASTEURISATION OF MILK.

By HENRY KENWOOD, M.B., D.P.H.,

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ALTHOUGH the term "pasteurisation" is a term implied to denote a procedure the details of which may vary considerably, let me broadly define it as the exposure of milk (previously cleansed by filtration or centrifugalisation) to a temperature not exceeding 70° C. for a short period; and then rapidly cooling it to a temperature as much below 16° C. as possible. Under such conditions it is possible (*a*) to reduce the micro-organisms which are capable of being cultivated on artificial media to less than 5 per cent. of those which can be cultivated from the original milk; to thereby destroy or inhibit the fermentation bacteria so as to delay the natural souring of the milk some twenty-four hours or more, the milk meanwhile keeping perfectly wholesome; (*b*) to destroy the specific organisms of tuberculosis, diphtheria, enteric fever, cholera, and dysentery, and doubtless also, in large measure, those organisms that are causal of zymotic diarrhœa; (*c*) to do away with the necessity for drugging the milk with harmful chemical preservatives. It is, therefore, a valuable measure of protection against the recurrence of those milk-borne epidemics which have figured largely in the epidemiological records of this country; it is a useful means of reducing the grave risks of the infection of tuberculosis in milk; and the evidence is overwhelming that it reduces the suffering and mortality among infants who are artificially fed. We have the high authority of Dr. Arthur Newsholme that at Brighton, in 1905, the child fed on raw cow's milk incurred a risk of dying during the first year of life that was nearly fifty times greater than in the case of children fed on their mother's milk; and even greater differences have been calculated in some other towns.

I believe in no other civilized country is raw milk consumed in such proportion as in our own, and yet practically all leading authorities in this and other countries inveigh against its use, especially in the summer

months. Is it not clear, then, that in the interests of preventive medicine we should make the dangers of artificial feeding the argument for obtaining breast-feeding whenever possible; but failing that, we should discourage the employment of raw milk for infant rearing until we attain to (if it is attainable in general practice) an absolutely pure milk supply? Even with a much-vaunted supply in Copenhagen I was astonished to see the large amount of dirt present in the milk arriving at the depot.

But although it is granted that the use of sterilized and boiled milk occasionally harms a child (for this is testified to by those whose findings are authoritative and beyond dispute), it cannot be in the public interest to discourage the use of such milk in face of the overwhelmingly greater dangers of raw milk. If one sets the danger of sterilized and boiled milk against that of the raw article, the former danger sinks into insignificance by the side of the latter. Those who rail against the use of sterilized milk say, in effect, that rather than one child should suffer from scurvy, some hundreds may be left to suffer or die of zymotic diarrhœa, etc.

Judging from the available evidence it must be extremely rare for *pasteurised milk* to cause infantile scurvy, and it possesses the additional advantages over sterilised milk that its taste is unaltered, the physical changes brought about by pasteurisation are practically *nil*, and the digestibility is increased (for the fat and lact-albumen are unchanged, the caseinogen is readily and completely coagulable by the rennin ferment into soft clots, and its digestion is not delayed; and there is no precipitation of calcium salts or changes in the phosphates). Pasteurised milk will not, of course, agree with all children any more than the mother's milk does; but infantile scurvy depends largely upon how long the milk is kept, and pasteurised milk is consumed in a far fresher condition than sterilised milk.

I maintain that pasteurisation is desirable in the health interests of the people, and this morning I propose to devote my contribution to this discussion to the consideration of the two great arguments which are advanced by those who disagree with me. There is the argument that by making dirty milk comparatively safe pasteurisation is opposed to the sounder principle involved in the demand for clean milk, and that it would prejudice the necessary reforms at the fountain head, the farm.

This is a conclusion drawn from two erroneous premises, and the argument only satisfies if it is assumed that it is not possible to improve conditions at the farm whilst pasteurisation is being practised; and that it is practicable to obtain milk so clean that the protection of pasteurisation will be unnecessary, *within a reasonably short time*. Now, if anyone

seriously argues from the latter standpoint, then he cannot have a first-hand knowledge of all the circumstances at "the fountain head" that tell against a perfectly clean and safe milk supply. Assuming that the money is forthcoming to bring the sanitary conditions at the farm to a wholly satisfactory standard (and I doubt it), then I maintain that we have only overcome the less of the two great difficulties which are to be surmounted before we can hope for milk that is safe to the infant consumer.

Assuming that we have obtained elaborate sanitary structural provision, it advances us very little in default of the prime necessity for the practice of elaborate cleanliness. How is the latter to be ensured until everyone at the fountain head is educated to *a deep conviction of the necessity for the highest refinements of cleanliness* (apart from the avoidance of obvious and gross dirt), and is trained to cleanly habits? Certainly not by any conceivable amount of administrative zeal on the part of district and county councils. The dairy farm premises of a county or large rural district, and the hours of milking, do not lend themselves to an adequate periodical inspection of the cattle and premises, much less to an adequate supervision of the collection, handling, and storing of the milk. Every effort must be made to provide this education and, if possible, the necessary training; but if anyone maintains that we are going to achieve all that is necessary in the course of a few years, I cannot share his optimism: for I know of farms sending milk to London companies, where the premises and workers have been under inspection by medical and veterinary experts acting for the companies, for some ten years, and the strainer affords eloquent testimony to the amount of grosser dirt that still gets into the milk. While this difficult and necessarily tedious process of education is advancing, and until its aims are realised, are thousands of children's lives to be sacrificed because, though we have a ready means at hand of saving them, the adoption of those means will offend a *principle*; or because it may be argued that it would jeopardise the earliest possible realisation of the scheme of dealing with the dangers at the source? We do not let such reasoning determine our actions in the general course of life when important issues are at stake, and personally my reasoning and my humanity are at war with it. *While, therefore, I strongly advocate doing all that is possible to bring about, as early as possible, the much needed reforms at the fountain head, I also strongly advocate the pasteurisation, which need not and ought not to prejudice those reforms.*

It is often stated (usually in the broadest of generalisations) that the pasteurisation of milk is a cooking process, which robs milk of its nutritional qualities, and may induce infantile scurvy and rickets.

I have spared no pains to inform myself of the case against pasteurised milk from the above standpoint, and I find little, if any, evidence to support the contention that the mere warming of the milk to a temperature not exceeding 70° C. for a few minutes occasions an alteration in its chemical or physical qualities that can materially reduce its nutritional value and induce disturbances of nutrition. One is struck, in investigating this matter, with the great lack of definiteness when the alleged drawbacks of feeding infants upon pasteurised milk are referred to, and often with the lack of scientific justification for the conclusions drawn. During the past year or two, medical colleagues have brought to my notice several instances in which pasteurised milk was alleged to have proved harmful. I was informed that the milk was pasteurised, but, on personal investigation, I have found in each case that either the milk was sterilised or boiled (a very different matter) or other food was given along with pasteurised milk. We are all, of course, equally desirous of arriving at the truth: and conclusions based on any but the most precise information upon all the facts may easily mislead us in this matter, and lead to an unwarrantable prejudice.

In conclusion, I would reiterate that the pasteurisation of the public milk supply affords a readily available means of bringing about a reduction of infantile sickness and mortality, even if the maximum is conceded to those who seek to discredit it. The experience of the marvellous effects of pasteurising the milk supply of the Foundling Asylum on Randall's Island is alone sufficient reply to those who depreciate pasteurisation of milk, and talk and act as if the disadvantages balanced the advantages.

But recognising as I do the extent of the home-contamination of milk, pasteurised milk supplied in bottles, at not more than 4d. per quart, is, in my opinion, an ideal public supply under present conditions: that is, until we attain to the general practice of elaborate cleanliness both at the farm and the home, and until every milch cow in the country is examined at least four times a year by an independent veterinary expert. When *that* time arrives the medical profession of *that* day will be justified in discouraging the pasteurisation of milk.

Prof. R. T. Hewlett (London) said that he was glad to see that Prof. Kenwood considered that pasteurised milk had not such a bad effect on infants as some had supposed. Personally, he thought that the ill effects of pasteurised milk had been much over-rated, and believed that any tendency to the production of scurvy might be prevented by the administration of raw meat or fruit juice.

One important point was, does pasteurisation kill disease germs? A great deal of research had been done on this question, particularly recently by Rosenau, of the Hygienic Laboratory, Washington, and it might be taken as proved that the temperature of pasteurisation would kill the micro-organisms of tuberculosis, typhoid fever, cholera, dysentery, diphtheria, and Malta fever. But the pasteurisation must be properly conducted, and should consist in heating the milk to 68°-70°C., and keeping it at that temperature for twenty minutes. With regard to the practicability of supplying pasteurised milk in bottles, undoubtedly the ideal system, at 4d. a quart, he must leave that to the trade experts to decide, and he hoped they would have an expression of opinion on that to-day.

In conclusion there were two drawbacks to the use of pasteurised milk which ought to be mentioned. First, pasteurisation would enable milk on the verge of becoming bad to be kept longer and sold, so that stale milk might be foisted on the public by unscrupulous dealers. Secondly, although a very large proportion of organisms was destroyed by pasteurisation, the few remaining soon multiplied under favourable conditions, and in forty-eight hours the milk might be swarming with microbes, although apparently good. Flügge years ago had shown that such milk did produce toxic effects in animals, and it could not therefore be considered as harmless. Pasteurised milk, therefore, ought to be consumed soon after pasteurisation, and possibly this might be ensured by compulsory dating the bottles in the case of a bottle supply.

Dr. Ralph Vincent (London) said that some years ago he had carefully considered the question of the relative merits of sterilisation and pasteurisation, and had published his views, which were largely those put forward in the paper they had just heard.

Sterilisation was wholly unnecessary: it had been conclusively shewn that pasteurisation at temperatures much below boiling point was quite sufficient when the milk was intended for consumption within forty-eight hours. He considered 75°C. too high. At this temperature, or at a temperature only a degree or two higher, all the changes characteristic of sterilisation occurred. In his experience exposure of milk at a temperature of 150 degrees Fahrenheit for fifteen minutes was ample. He had tested this by crucial experiments repeatedly.

Both sterilisation and pasteurisation prejudicially affected milk as a food for infants. Those who advocated pasteurisation of milk would only do harm to their cause if they pretended otherwise. If milk that was dangerous by reason of its contaminated condition had to be used, then by all means pasteurise it, as the best thing *in the circumstances*. But we must not forget that dirty milk remains dirty milk, however much it be treated. Pasteurisation is a method to be recommended as the best practicable thing in many conditions: it should be ordered on this principle for the individual infant by the person in charge, doctor, nurse or mother.

He thought he noticed a tendency in Dr. Kenwood's paper to advocate the

pasteurisation of all milk offered for sale. He was bound to oppose any such recommendation. Milk is a natural fluid, and it is the business of the vendor to supply it in its pure and natural condition. To authorise or permit him to enter upon any treatment or artificial manipulation of milk would be to embark upon a course of procedure most dangerous, and certain in the long run to do an infinitude of harm. Among other things, it would tend directly to encourage the unscrupulous milk vendor as against his more conscientious rivals. He agreed with Dr. Tanner Hewlett in regard to the extremely dangerous character of pasteurised or sterilised milk that had undergone decomposition, especially as these changes frequently could not be detected either by taste or smell.

DR. DAVID SOMMERVILLE (King's College, London) said that the term pasteurisation was indefinite and somewhat mis-leading in that no definite temperature and no time of heating were fixed, and further in that the heated milk was not necessarily clean, fresh, or unsophisticated. In selecting time and temperature, the controlling factor must be the thermal death point of the most resistant pathogenic micro-organism met with in milk. That was sometimes difficult to determine, as shown by the most conflicting statements that had been made concerning the thermal death point of the well-known tubercle bacillus. Whilst a temperature of 75° C. applied for some minutes would doubtless destroy the pathogenic bacteria ordinarily found in milk, it must not be forgotten that the spore-bearing and peptonising bacteria resisted much higher temperatures. Some of those, such as the *B. putrificus* of Bienstock, the *B. aërogenes capsulatus*, etc., produced in infants vomiting, diarrhœa, and death. It appeared to him that pasteurisation was not always safe; and that where milk could not be obtained whole, clean, fresh, and cool, and could not be used within a short time of its being taken from the cow, it should be heated a little further and so rendered sterile. Sterilised milk had been objected to by reason of an alleged difficulty in connection with the digestibility of its protein, and because of the danger of its producing infantile scurvy. He believed that the disturbing element in the digestion of cow's milk was the fat and not the proteins. If one treated some human milk with rennet, a fine flocculent precipitate was formed: if skimmed cow's milk were similarly treated, a corresponding flocculent precipitate appeared; but if a sample rich in fat were treated, a bulky tough mass of curd was the result. There was sufficient evidence now to show that the digestion was easier and absorption greater in cooked than in raw milk. Where scurvy appeared to be due to sterilised milk (it was often caused, he believed, by other and especially starchy foods) it should not be attributed to the heating but to inherent qualities in the milk, most of all to a lowering in quantity of alkaline bases. Such bases must be supplied in the food in combination with an acid radicle which could be set free by the digestive juices, as citric, malic, phosphoric, etc. It would be found in those instances where scurvy supervened that those salts were relatively insufficient when compared with the

fat present. Excess of fat drew upon the alkaline bases for purposes of saponification: one constantly met with that condition in those cases where low protein and high fat obtained through diluting top milks and cream with water. In condensed milks and proprietary foods, the large volumes of water added reduced the salts below the limits demanded by the body. He could find no proprietary food on the market which approached cow's milk in respect of its content of alkaline salts. He agreed with Variot that milk sterilised at over 100° C. retained the whole of its nutritive value, and was not inferior to milk pasteurised at 80° C. The destruction by heat of the enzymes, the slight alteration of the lactose, the precipitation of small quantities of citritate of calcium, or the slight change in the lecethins, did not affect its digestibility, absorption, or assimilation: the clinics of Budin and Variot, where sterilised milk alone had been used, and scurvy practically never seen, stoutly supported this contention.

Instead of receiving too little fat many infants got too much, and the physical conditions which followed had their explanation in that fact. The most casual examination of the stools of an overfed, flabby, and anæmic baby that was passing curds would demonstrate that the so-called curds were not proteins, but soaps, neutral fats, and bacteria.

Such infants became restless and nervous, lost appetite, and later passed stools of a consistency of putty containing fatty soaps and solid masses of putrefactive bacteria. If the fat were cut off in time and the remaining constituents of the dietary reduced to those quantities that could with ease be digested by the child, such cases invariably recovered. That the extraction of alkaline bases was there occurring on a large scale was further shown by the increased elimination of ammonia in the urine.

Scurvy was found in infants fed on the breast, in others fed on raw milk, and there was no scientific evidence that he could find, nor clinical evidence worth the name, that supported the view that the mere heating of milk produced scurvy. Where scurvy occurred other factors were invariably present.

All milk, but especially that intended for infants, should be obtained from the most healthy cows in an aseptic condition, should be immediately cooled to and kept at, say, 7° or 8° C., and used within twenty-four hours. The matter of cost should not stand in the way of that ideal. Milk that for any reason must be kept should be sterilised immediately it was drawn from the animals. The intermediate condition of pasteurisation was unsatisfactory by reason of the fact already stated, viz., that putrefactive sporing organisms remained unkilled.

Dr. A. E. Porter (Reigate) agreed with Dr. Kenwood in his opinion that a supply of pure, clean, cooled, bottled milk could not be relied upon as a general measure for many years to come, if ever. The choice therefore lay between the application of heat and the addition of a reliable and harmless germicide, if such could be found. Hydrogen-peroxide, used in the method advocated by Mr. Budde, might perhaps fulfil these requirements.

He said if the application of heat were decided upon, pasteurisation would be preferable to sterilisation. Many charges had been brought against pasteurised milk, probably in a large degree owing to the looseness with which the term had been used: namely, any temperature between 140° and 212° F., and for any period between five and thirty minutes. He would define pasteurisation as the maintenance of milk for not less than twenty minutes at a temperature not lower than 150° and not higher than 160° F. (65°—70° C.).

If pasteurisation was decided upon, it must be carried out either at central depots, municipal or otherwise, or at the home. If at central depots, it must be bottled, and he was afraid that the cost would be increased. Such milk was procurable at the present time at large dairies, but always, so far as he was aware, at an increased price. An increased demand might possibly remove this disadvantage.

If pasteurisation was to be carried out at home, it was doubtful if it could be introduced into the dwellings that figured chiefly in mortality statistics among the young. The process was not a simple one, and an inexpensive apparatus without complications would be essential. If the apparatus devised by Mr. Nathan Straus fulfilled the temperature requirements, possibly its use might be popularised through the general practitioner, supplemented by demonstrations by health visitors, where such were employed by the local authority.

At best, pasteurised milk must be looked upon as an inferior article to pure fresh milk.

Dr. E. Nash (Somerleyton) supported Dr. Vincent in opposing the idea of universal pasteurisation, and also criticised the utility of the statistics of the sterilised milk station at Battersea, stating that scurvy was only realised by ninety-nine per cent. of the practitioners in its later stages, and that the earlier stages, as instanced by anæmia and general irritability, were never regarded as having any connection with scurvy or the causes that produced it. Dr. Nash contended that a large number of these debilitated anæmic children were the result of feeding on pasteurised or sterilised milk, and formed a class which did not appear in the mortality tables of the past two years, but were, he believed, more liable to be carried off by other diseases later on, and he considered that the Battersea statistics would not be of full value until the cases brought up on their milk were followed over six to eight years.

He advocated the stricter supervision of farms and dairies as one of the steps towards the obtaining of a clean milk, one of the first of which must be the whole time medical officer of health with security of tenure.

Mr. C. Revis (Paddington) said it seemed to him that the question of pasteurisation might be considered under three heads. The first, which was the power of pasteurisation to destroy pathogenic organisms, he thought we might

take as settled as regards its efficacy if pasteurisation be carried out in a proper and scientific manner. The next was the vexed question of whether or not pasteurised milk was the cause of scurvy, rickets, and kindred disorders; which question had not yet been settled, and he scarcely thought that it was likely to be settled within the lifetime of any of those present.

The chief question was the commercial pasteurisation of milk on a large scale, and it required very careful consideration. It was true that the large dairy companies in London, who were endeavouring to supply raw milk in as proper, clean, and hygienic condition as possible, would (if called upon) supply pasteurised milk which would be above suspicion; but, at the same time, all sorts and conditions of milk, of varying age and condition, clean and unclean, would be foisted on the public by unscrupulous vendors, and there was practically no means by which any control could be exercised over such nefarious practices. There was one dogma which one might lay down, and to which there would be scarcely any exception. It was this: Raw milk never putrefied; pasteurised milk always did. It was quite certain that pasteurised milk underwent a decomposition which raw milk never did. This decomposition was caused by the development of sporogenous organisms, and we were completely in the dark as to what toxins or other undesirable products might be the result of such fermentation. He had considerable experience in examining and testing various kinds of commercial pasteurisers, and he would never forget the results obtained with one invented by Baron von Pfieff, which were excellent. Even though the milk had been heated considerably above the temperature necessary for pasteurisation, it was delivered by the machine without any of that boiled taste so easily taken on when milk was overheated. Some of the milk was kept, and was sweet to the taste after four days. It was, however, at that time simply teeming with organisms, and he would be very sorry to imbibe such milk, as the results might be anything but desirable.

It was probable, when pasteurised milk was bought as a commercial article, that, owing to the fact that it did not normally sour as ordinary milk did, it might be kept in warm weather sufficiently long to develop unseen but very probable toxic conditions. There was, however, one perhaps still more important question, though to a certain extent on the theoretical side, and it had practically not been touched by any of those who had as yet spoken. At the present time the importance of the presence of lactic acid organisms in the alimentary canal as an antidote to dyspepsia, and other disorders of the stomach of a like nature, was being very strongly impressed on us from the work of Prof. Metchnikoff and others, and he had himself seen some wonderful results occur in that treatment of digestive troubles. Now if certain forms of dyspepsia seemed to be the result of a lack of lactic acid organisms in the alimentary canal, and might be greatly ameliorated by the ingestion of large quantities of such organisms, it behoved them to exercise the greatest care in completely and entirely shutting off the almost sole supply of those organisms to the population

of London by a universal system of pasteurisation, as organisms of that class were most certainly killed or seriously attenuated by the temperature requisite to ensure proper pasteurisation.

Mr. H. Droop Richmond (London) said that pasteurised milk should not be heated to 75° C., as this was beyond the point at which albumen underwent a change, and it was near the temperature at which destruction of the enzymes could be detected. There was no trouble in pasteurising milk at temperatures between 150° and 160° F., and the temperature certainly should not exceed 160° F. He drew attention to the work of Babcock, Russell, and their co-workers, in which the importance of agitation of the milk during heating was pointed out. They had pasteurised milk at temperatures as low as 140° F. when well agitated, while considerably higher temperatures were ineffectual if the milk was still.

Under commercial conditions he had found as average figures that, if the milk was kept in rapid motion, ten seconds' exposure at 160° F. destroyed 97 per cent. of the micro-organisms; six minutes was sufficient to destroy 99·5 per cent.: and in fifteen minutes 99·7 per cent. disappeared. He suggested that it was possible that some at least of the evil effects attributed to pasteurised milk might be due to the destruction of the lactic acid producing organisms, and referred to the views of Metchnikoff as to the importance of organisms producing lactic acid. In ordinary milk the organisms not destroyed at 160° F. were crowded out by the lactic ferments: while in pasteurised milk they had no opposition, and could rapidly increase.

Referring to the price of pasteurised milk in bottles (4d. per quart) mentioned by Professor Kenwood, he pointed out that while pasteurisation was not very expensive, the loss due to breakage and non-return of bottles was appreciable. If pasteurised milk had to be sold in bottles at 4d. per quart, it meant either that no profit would accrue to the vendor (and while he might put up with this for a little time for the advertising advantages, or to gain custom, it could not continue permanently), or economies either legitimate (such as the reduction of the number of daily deliveries) or illicit (by reduction in quality) would be necessary.

Dr. G. Quin Lennane (Battersea) acknowledged his obligation to the excellent paper of Professor Kenwood, with the contents of which in the main he was in agreement. At the same time he was strongly of opinion that the controversy which raged between those who believed in pasteurising and those who favoured sterilisation, was much overdone. After his experience in connection with the Battersea Municipal Milk Depot, he would have, he feared, to proclaim himself a heretic, as he gathered from Professor Kenwood's paper, and from the tone of the discussion so far, that sterilisation was not looked

upon with any degree of favour. When, two and a quarter years ago, he took over the charge of the Battersea Municipal Milk Depot in succession to Dr. G. F. McCleary, now Medical Officer of Health of Hampstead, he was imbued with the same theoretical objections to the use of sterilised milk which Dr. Vincent had so strongly raised.

It was said that a little practice was worth a large amount of theory, and it was owing to the practical experience which he had while supervising the feeding of some 1,500 babies during the past two years, that he was compelled to discard his theoretical views as to the (alleged) dangers of sterilised milk. So far as he could see, these were greatly exaggerated. For example, during the past year the Battersea Depot had fed nearly 700 children. He gave a few details as to the number and the length of time during which these babies were fed on the sterilised milk, as follows:—

PERIOD FED.							
Under 1 week.	1 week and under 1 month.	1—3 months.	3—6 months.	6—9 months.	9—12 months.	Over 12 months.	TOTAL.
36	64	158	136	98	62	64	618

It would be seen that the majority of those children were fed at the earlier ages, and that a considerable number had been fed for long periods. It was reasonable to anticipate that if the use of sterilised milk favoured the development of morbid conditions there would have been ample opportunity of observing such. That was the more probable, as he was not dealing with a normal infant population, fully 80 per cent. of the children having been recommended by medical men because they were suffering from some more or less serious condition of ill health when they were admitted to the milk depot. Furthermore, many of those children were suffering from scurvy or rickets when they commenced to take the milk, and notwithstanding, in the majority of instances, they immediately began to steadily improve. In only two instances, although 50 per cent. of the infants came weekly under his supervision at the weighing room, did he observe rickets develop while the children were fed on sterilised milk. He could not, therefore, shut his eyes to the fact that as regards the theoretical disadvantages of sterilised milk to the infant, practically there was no evidence to support them so far as his experience went. He would not prefer sterilised milk to pasteurised, nor was he arguing from that standpoint. What he most desired to bring home to the meeting was that from practical observation there was little or no evidence that the use of sterilised milk was harmful to the growing infant.

The problem of the milk supply of London was a big question. It was probable that by legislative action great improvement could be effected in the present supply. He agreed that a pure unsophisticated milk direct from the cow, modified to suit the respective ages, was the best substitute for mother's milk for the growing infant, but he did not think that even by means of legislative action you were going to obtain an ideal milk supply. It would, particularly among the poorer classes of urban communities, still be necessary to take precautions, either by pasteurisation or sterilisation. Even were the use of sterilised milk harmful, it was infinitely less dangerous than polluted and disease-infected milk, conditions which there was abundant evidence to show characterised much of the milk supply of London. He would, until he had evidence to the contrary, continue to take the precaution of recommending the use of either sterilised or pasteurised milk. The best rule to follow was to pasteurise in cold weather and sterilise in hot.

Dr. Beresford Kingsford (London) asked, did Prof. Kenwood think that it was, at present, possible so to standardise milk, by bacteriological and other tests, that reliable certificates of merit could be awarded to those vendors whose milk passed such tests with credit?

From the remarks made by several authorities there that day it seemed that the changes produced in milk by pasteurisation were not yet all fully understood; moreover, the process itself was a somewhat technical one, and if adopted on the large scale would, in many districts, require considerable supervision.

By the unlearned farmer or dairyman the milk might be overheated, and so made less digestible, and perhaps, also, less nutritious. Or it might be heated too little, and the inadequately-treated milk might be consumed after it had become stale (or bad), under the erroneous belief that all milk sold as pasteurised milk would be sure to keep good for a certain number of hours.

Professor Kenwood had confessed that he was not optimistic as regarded the value of inspection, yet the process he advocated would surely call for more inspection and supervision than ever.

The better plan was to make it worth the vendor's while to strive after perfection, rather than to so arrange matters that he had no inducement to do more than was necessary to pass muster with the inspectorate of his district. It was better to strive after approbation than to seek only how one might just escape censure.

Certificates from reliable institutions (*e.g.*, The Royal Sanitary Institute or Professor Kenwood's laboratory) would be worth a good deal as legitimate advertisements, the more so as the poorer classes came to appreciate the value and importance of a pure milk supply. In time even they might learn to patronise only those purveyors who could always show up-to-date certificates of merit. The advertisement would help to pay for the examinations, and most of

the inspection could be done away with if it *paid* vendors to always supply a reliable article.

No doubt the milk of certificate holders would command a higher price at first, but, if certification became general, competition would probably soon bring down prices all round to a normal level.

Dr. W. A. Bond (Holborn) said it must be remembered that the human organism was very complex: also the old adage that one man's food was another man's poison. Many infants did not thrive even on their mother's milk; and many breast-fed infants died in the early months of life from malnutrition and wasting diseases.

In Holborn they had arranged with a large dairy company to supply modified milk without any cost to the council, and the majority of the infants thrived well and did not suffer from scurvy. It was better, therefore, to be guided by practice than by theory, especially as many of the theories had not been proved to be correct.

Other foods, as well as sterilised milk, were often given to infants by mothers, and these foods were more likely to be the cause of any scurvy that might occur. Dr. Nash owned that the scurvy was often deferred until after the first year of life (which certainly was better than their suffering earlier), and such infants had then almost certainly been fed with other food than milk.

He could not agree with Dr. Sommerville that the cost of the milk did not matter, for it was found that many of the mothers could not afford to pay even 4d. per day for modified milk; in fact, in exactly half of the cases of children who had modified milk last year, on account of the poverty of the mothers half of the cost was paid by one of the councillors.

The pasteurisation of milk was not practicable in the homes of the poor.

It was also stated that the cost of bottles would be prohibitive. He could not agree with this, for empty milk cans were returned, so why not also empty bottles?

In dealing with this question the proper sense of proportion was wanted, and he therefore agreed with Professor Kenwood that "those who rail against the use of sterilised milk say, in effect, that rather than one child may suffer from scurvy, some hundreds should be left to die from zymotic diarrhœa, etc."

Mr. Nathan Straus, who was unable to attend, telegraphed from Langenschwalbach as follows:

Regret exceedingly inability to be present. Pasteurisation is at present the best remedy against high infantile death-rate. Pasteurisation should begin where breast-feeding ceases; each day's supply should be pasteurised and modified to the needs of infants. In Sandhausen, near Heidelberg, where death-rate was abnormally high, I succeeded during the last four months to reduce it just to one half by simply pasteurising the same milk as used before;

and everywhere in America where pasteurisation was introduced the death-rate was reduced immediately. In sixteen years' experience I have always achieved the greatest results during the hottest months of summer.

DR. KENWOOD (London), in replying to the discussion stated that he could assure those who had raised the question as to whether pasteurised milk in bottles could be supplied at 4d. per quart that several Companies were now doing so, at a fair profit; and, as a matter of fact, he had been supplied for the past eight years with sterilized milk in bottles at that figure. He considered that any suggestion which involved an increase in the cost of the milk was no satisfactory solution of the problem they had to face: and Dr. Vincent's suggestion that pasteurisation should only be recommended in individual cases under skilled advice, lost sight of the fact that the bulk of that class among whom the infants suffered most were quite unable to procure advice. He was of opinion that, so far from the cost not being allowed to stand in the way of the ideal milk supply, as suggested by Dr. David Sommerville, the cost was, as he had defined in his paper, a most important determining condition for an ideal public supply. He considered that the actual instances in which the mere substitution of a pasteurised milk supply, for a raw milk supply, had reduced the mortality amongst infants some 50 per cent. (as at Randall Island and elsewhere), afforded sufficient argument that whatever the disadvantages of pasteurisation may be, the net advantages bulk enormously in comparison with them; and he based his conclusions as to the great exaggeration of the harm of pasteurised milk from the circumstance that competent medical men, with great experience of infants, testify to the very rare occurrence of any untoward consequences. He considered that the late Professor Budin's experiences were almost unique: and he had in his possession a letter written by that authority, only a few months before his death, in which he testifies to his unshaken belief in the fact that the use of pasteurised milk involved practically no danger of scurvy.

In reply to Dr. Kingsford he would like to say that the certificated milk which he suggested had met with a good sale in some countries; but the cost was prohibitive to the poorer people, and he did not believe that milk produced under all the conditions of certification could be produced and sold at 4d. per quart. The process advocated certainly called for inspection and supervision, but inspection and supervision at the depots and dairies from which the milk is sold to the people. Such inspection and supervision is very easy compared to that of the isolated farm premises in rural districts.

DR. BUTLER (of Willesden) and DR. H. STOTT (of the East Sussex combined Districts) also took part in the discussion.

SCHOOL HYGIENE IN AUSTRALIA.

By H. CUMPSTON, M.D.,
Medical Officer of Health, Central Board of Health, Western Australia.

TO understand the conditions existing in Australia it must always be remembered that Australia is a large continent, with an area of 3,077,657 square miles, so that there is ample room for variation.

This continent is divided into six states: five on the mainland, and the island of Tasmania. Each of these has self-government in local affairs, including education; so that when the subject of school hygiene in Australia is considered it must, of course, be remembered that each of the six states approaches the matter in its own way. A short account of the work in each place has been obtained from the departments respectively concerned, and these are given below.

It will be seen that all over Australia the authorities concerned are energetically working towards the adoption of the measures most effective for the conditions obtaining in each place.

There is a great difference between the conditions under which medical inspection of school children is carried on in a country like England and those which a medical school officer would have to deal with in Australia. The distances between schools is often so great and the number in each place so small, that there would not be nearly enough time for one or even four or five medical men to completely cover the ground in each year. So that in all probability the medical inspection of school children will for the present be confined to the large centres of population.

A scheme is now being drawn up, and will probably soon be put into operation, by which a simultaneous examination of a large number of children will take place through the whole Commonwealth of Australia. When this is completed, statistics will be available for comparison with those of older countries.

Victoria.

During November and December, 1905, Dr. E. Robertson of the Central Board of Health conducted an examination of 384 children from two types of schools, (*a*) in industrial suburbs, (*b*) in residential suburbs.

As a result of the conditions revealed, the Chairman of the Central Board of Health, Dr. Norris, addressed a memorandum to the Government of the State, setting out the urgent desirability of appointing a medical officer for schools. This has not yet been accomplished, but it is expected that very shortly a full-time medical officer of schools will be appointed.

In Victoria practically the whole of the primary education is carried out by the State, but the secondary education is entirely served by private enterprise. The Government, however, exercise a rigorous supervision by means of the Registration of Teachers and Schools Act, 1905.

In this Act "school" means an assembly of three or more children at appointed times for the purpose of their being instructed by a teacher in all or any of the under-mentioned subjects, namely, reading, writing, arithmetic, grammar, geography, English or other language, mathematics; but does not include the University of Melbourne or any college affiliated therewith, or any assembly of children all of whom are members of not more than two families, or any State school, or any school aided by the State.

A Board has been created, in accordance with the terms of the Act, consisting of ten members; of these three shall be appointed as representatives of the education department, four shall be appointed as representatives of schools other than State schools, two shall be nominated by the council of the University of Melbourne, one shall be appointed as a representative of State-aided technical schools.

Every school and teacher must be registered with this Board within a time to be fixed by the Board.

Every person who shows evidence that for three consecutive months prior to the passing of the Act he was employed or acted as a *bonâ fide* teacher will be registered by the Board.

After July 1st, 1906 (*i.e.* after the first six months of the existence of the Act), no person shall be registered as a teacher unless he produces evidences which shall satisfy the Board as to his fitness to teach.

All school premises must satisfy the Board of Health in all structural qualities.

Queensland.

The Commissioner of Public Health, Dr. R. B. Ham, in a report to the Home Secretary, emphasises that "a more general movement towards a systematic inspection, or at least an adoption of a systematic method of inquiry into the health and physical culture of the children in our public schools is exceedingly desirable."

The question of acute contagious ophthalmia among the children of

the drier country districts in Queensland is an urgent one. Dr. Ham, in his Annual Report, 1907, points out that "this disease is of a highly contagious character," and "is largely disseminated through the medium of schools." He further quotes a medical man with large experience of this condition to the effect that no inconsiderable proportion of the children so affected run the risk of becoming incurable or permanently blind.

Dr. Ham is energetically pushing the question of school hygiene, and it may therefore be expected that before long Queensland will have a well-organised system of medical inspection in schools.

South Australia.

In South Australia the movement in the direction of the establishment of school hygiene is as yet only in the beginning. The chairman of the Central Board of Health, Dr. Ramsay Smith, has been continually reminding those in whose hands the matter chiefly lies, as well as the general public, of the necessity of taking action in the direction of medical inspection of school children.

There have been for some years courses of lectures on school hygiene as part of the regular curriculum at the training college for teachers; and now there has already been a medical inspector appointed to undertake the work of inspection of school children.

As a commencement the examination is to be undertaken of 1,000 children from schools in the metropolitan area, in county towns, and in distinctly rural districts.

This work will afterwards be extended and the direction of this extension will be determined by the results of the examination now proceeding.

Western Australia.

The work begun by Dr. Blackburne (whose own report is given below) has been used as a guide for the establishment of a routine method. The schools in this state are scattered over about 250,000 sq. miles, so that it is obviously impossible that one person should cover the whole area. The children in the country districts, however, enjoy on the whole sufficiently good health to render a routine medical inspection unnecessary. Advantage is taken of opportunities afforded when the medical officer for schools is in any country district on other work to make an examination of the school children. In the urban districts, however, a continuous routine practice is now made of examining children as they enter the school, so that the existence of defects, physical or mental, may be discovered and the attention of the parents drawn to it.

The medical officer of the Central Board of Health, who is charged with the supervision of school hygiene, has also many other functions, and cannot hope, at present, to do more than examine new scholars, with the possible extension of the work to include the examination of those about to leave school, and a third examination of children between the ages of 9 and 12 years. In later years this small beginning will be extended, so that eventually there will be one or more medical officers whose time will be entirely devoted to medical supervision of schools.

In addition to the work described relating to the children, there is also much work being done in the instruction of the teachers. A course of lectures on school hygiene is given as a regular part of the curriculum at the teachers' training college.

An article on the same subject is published in the *Education Circular*, which is issued monthly.

There has also been issued by the Education Department an excellent manual on hygiene in its relationship to all matters with which a teacher is likely to be brought in contact, which consists of a series of outline lessons through which the teacher is to take the classes during the course of the year.

Appended are the Building Rules issued by the Education Department of Western Australia.

APPENDIX VI.—Building Rules.

(A.)—Planning and Accommodation.

Schools (subject to the extent of site permitting) to be one storey in height, and planned on the combined corridor and central hall system (with special view to facility of extension), in accordance with these rules; and, in case of additions, so that the least possible disturbance to the portions already built, or in occupation, may be occasioned.

(B.)—Walls, Floors, and Roofs.

1. In all rooms used for teaching the ceilings to be level at the wall plate, and to be 14 ft. clear height from floor.
2. A damp-proof course to be provided in all brick and stone buildings.
3. Brick walls to be built with a cavity where exposed to driving rain, and to be plastered inside, having a cement dado trowelled to a glass face 4 ft. high in class rooms and 5 ft. high in corridors and central hall.
4. The inside jambs of all windows to be plastered, so as to avoid the use of projecting architraves, nosings, etc., which accumulate dust.
5. The dados, walls, and ceilings to be painted in colours to be approved.
6. The floors throughout to be of wood.
7. The spaces between the roofs and ceilings to be well ventilated; gables to be used accordingly in preference to hips wherever possible.
8. All spaces under wooden floors to be well ventilated.

(C.)—Entrances.

1. Separate entrances to be provided for:—

(1) Boys, (2) Girls and Infants;

and, in more advanced stages,—

(3) For Infants only (separate from Girls' entrance).

2. All exterior doors to open outwards only, and all class-room doors to open inwards.

3. Escape doors to be provided, if deemed necessary in any special case, for use only in the event of panic or fire.

4. External porches to be provided where necessary for protection of entrance from sun or weather.

(D.)—Cloak Rooms and Lavatories.

1. Heights of lavatory benches to be:—For Infants, 1 ft. 11 in., and for older children, 2 ft. 2 in., with one basin or jet for about every 20 children. (For wastes, etc., in connection with basins, see Sanitation.)

2. Hat pegs to be spaced 15 in. apart, in three tiers, set quincunx, at heights of 2 ft. 3 in., 3 ft., and 3 ft. 9 in., respectively, for Infants; and 3 ft., 4 ft., and 5 ft. respectively, for older children.

(E.)—Class-Rooms.

1. Class-rooms to be calculated at not less than 11 square feet of floor space for each child.

2. The standard size of class-room to be:—For 50 children, 26 ft. by 22 ft., or 24 ft. by 24 ft.; and for infants' rooms (in the mixed schools), 35 ft. by 24 ft.

3. Class-rooms to be on the same floor level as the corridors, and to have movable steps, three in number, and each 3 in. in height, to enable dual desks to be graded.

3A. Grading not to be introduced in schools provided for less than 100 children.

4. Class-rooms to be planned so that they may be cleared quickly and without disturbance to other parts of the school.

5. Map-rails, with hooks, to be fixed at a height of 10 ft. 6 in. all round the walls.

6. A blackboard, 3 ft. 3 in. deep and 2 ft. 6 in. from floor, to be fixed along the whole length of wall opposite the desks, and also in central halls and corridors when required.

7. A good-sized cupboard for stock to be provided to each room, and a stationery store next the teachers' room.

8. Class-room doors to have glass upper panels.

9. Every class-room to have an open fireplace.

(F.)—Halls.

Where central halls are not provided, grading may be omitted in one of the class-rooms.

(G.)—Teachers' Room.

In the larger schools (for more than 150 scholars) a teachers' room to be provided, the dimensions 16 ft. by 10 ft.

(H.)—Verandahs.

1. Where protection against weather or sun is necessary, a verandah of sufficient extent, and not less than 10 ft. in width, to be provided.

2. These verandahs to have a gravel floor; to be provided with wooden seats, and to serve as shelter sheds for each sex.

(I.)—Windows.

1. Every part of the school building to be amply lighted.

2. The minimum area of glass in a class-room of the 24 ft. by 24 ft. size, to be 65 square feet.

3. All main windows in rooms used for teaching to be planned generally on the South or East sides only, and on the left side of the children's seats or benches.

(1.) The sills to be 4 ft. from the floor, the windows and fanlight reaching to the ceiling.

(2.) Each fanlight to be hung on centres, the windows to have double hung lifting sashes.

(3.) The windows to be arranged so that the first jamb is at 2 ft. 6 in. from the wall at the back of the children.

(4.) Each class-room to have three or four windows within its length.

(5.) Where verandahs are necessary on account of a North or West aspect, special provision to be made against obstruction to the lighting of the class-room.

(6.) Spring-blinds hung at the transoms to be provided where necessary.

(J.)—Ventilation.

1. Fresh air to be admitted into all rooms by approved patent fresh-air inlets, six in number to each infants' room, and four to each class-room.

2. All doors from corridors to class-rooms to be provided with hinged fanlight to secure thorough circulation.

A double-hung sash window 6 ft. by 3 ft. to be placed in wall opposite other windows for current of fresh air. Sill to be 8 ft. above floor.

3. Outlets for foul air to be provided in the walls at ceiling height, and in the ceilings by bell-mouthed gratings (two for each 4,000 cubic feet), each pair leading into a separate tube, carried above the ridge of roof, and fitted with an exhaust cowl.

4. To secure a thorough circulation of air between the roofs and ceilings (of much importance under the Australian climatic conditions) louvres to be provided in all gable ends.

5. Where class-rooms have more than one external wall, small windows (hinged at top to open outwards) at the ceiling level to be provided for purposes of additional cross ventilation.

(K.)—Sanitation.

1. In the absence of any water-carried system of sewerage, earth-closets with pans to be used where a sanitary authority exists; in other cases the pit system must be employed.

2. In the former case, the latrine blocks for the two sexes to be placed back to back, with a cleansing passage between for access to the pans; and to be as far from the school building as circumstances will permit, and against the directions of the prevailing winds.

3. In each closet only one seat to be allowed: to be 2 ft. 6 in. wide for boys and girls, and 2 ft. wide for infants, with dividing screens 5 ft. high. A door, without a bolt and the height of the screen, to be provided to each closet, kept up 18 in. above the floor to enable the teacher to see whether the closet is occupied.

4. The height of the seat from floor will depend on the depth of the pan; broad steps to be provided adapted to the varying height of seats that may be required. Under-side of seat to be provided with guide rails for bucket. All fittings to be made easily removable for cleansing purposes.

5. The following table gives approximately the number of closets to be provided:—

For Mixed Schools.

	Teachers.	Girls.	Boys.	Infants.
35 Children or under	..	1 ..	1 ..	–
50 ,,	—	.. 1	.. 1 ..	1
75 ,,	1	.. 2	.. 1 ..	1
125 ,,	2	.. 2	.. 2 ..	2
175 ,,	2	.. 3	.. 2 ..	2
225 ,,	2	.. 3	.. 2 ..	2
275 ,,	2	.. 4	.. 3 ..	3
325 ,,	2	.. 5	.. 3 ..	4

For Senior Schools.

	Teachers.	Girls.	Boys.
200 Children or under	2 ..	4 ..	3
250 ,,	2 ..	5 ..	3
300 ,,	2 ..	6 ..	4
350 ,,	2 ..	7 ..	4
400 ,,	2 ..	8 ..	5

For Infants' Schools.

100 Children or under	1 ..	4 ..	3
150 ,,	1 ..	5 ..	4
200 ,,	1 ..	6 ..	5
250 ,,	1 ..	7 ..	5

6. The pan doors and risers of closet to be kept clear of both head and sill and of floor, respectively, to secure a thorough current of air.

7. Urinals to be arranged as under:

(1.) To be outside the latrine building, and open to the air, and to be enclosed by closed screens, 5 ft. high, with a separate small pent roof to shield the boys' heads from the weather. In special cases the urinal to be roofed over, with openings all round for ventilation.

(2.) The floors to be of cement or asphalt, with a fall of 1 in. to the foot towards a deep channel in the floor, having a rapid fall and well tarred all over.

(3.) No trough to be used.

(4.) Generally the urine is to be conveyed by glazed or earthenware pipes to a well-ventilated soak well about 30 ft. distant.

(5.) In districts where the local regulations require discharge into a pan, such pan should be tarred and enclosed, and be of convenient size for the periodical removal.

(6.) The back of the urinal to be of galvanised iron, well tarred, and of the following lengths :—

For	50	Children ..	6 ft. long.
„	100	„ ..	10 ft. „
„	200	„ ..	15 ft. „
„	300	„ ..	20 ft. „
„	400	„ ..	25 ft. „

8. The openings to Infant Boys' latrines to be from the Girls' playground.

9. The lavatory basins to empty direct into a galvanised iron tarred trough under the shelf, and be connected to a rapidly falling waste pipe discharging through the outside wall over a short channel leading to an open gully grating. No enclosure of the lavatory bench to be permitted.

10. Lavatories to be provided with towel rails on walls as required.

(L.)—Sites and Playgrounds.

1. A school-site being one of the first reserves made by the Government in laying out new townships, should be generally central in position and of ample size.

2. Separate playgrounds and gates to be provided for (1) Boys, and for (2) Girls and Infants.

3. Each playground (in the larger schools) to have a light shelter shed, unless verandahs are provided for the purpose against the school building.

4. The rails of fences dividing the playgrounds to be always fixed on the girls' side.

(M.)—Infants' Schools.

1. The foregoing general rules apply to Infants' Schools, with the following additions :—

(1.) Infants' Schools to have a central hall with surrounding class-rooms opening therefrom.

(2.) An escape door may be provided for the hall.

(3.) The class-rooms to correspond in all respects to those of mixed schools.

(4.) On the North side a verandah 10 ft. wide to be provided with seats.

The Medical Inspection of School Children in Western Australia.

In April, 1906, the Public Health Department was authorised to begin the work of medical inspection of school children in the State, and I was instructed to carry out the details. It was then decided that before instituting any scheme or system for permanent application, a general physical survey of as many children as possible should be undertaken for the next few months, and for this purpose a schedule

had to be drawn up to be filled up for each child. The schedule used by the Royal Commission on Physical training, Scotland (1903) was taken as a basis on which ours was drawn.

As finally drawn up, it provided for the usual anthropometric data of height, weight, and chest measurement (though this latter was found so difficult to obtain and so unreliable that it was mostly not filled in); condition of eyes, including refraction; condition of ears, teeth, throat, nose, and glands; deformities; heart and lungs.

As this State comprises communities characterised by such various climatic and industrial conditions, it was decided to examine the older children in the principal school in each of certain centres. In this way it was considered that we should obtain data which would be interesting for comparison, *inter se*, as well as with those of outside. Under this plan the principal school in Perth, Fremantle, Kalgoorlie, Boulder, Bunbury, and Albany was taken. It may be explained that Perth is the metropolis ten miles inland, Fremantle being its seaport, the two forming practically one centre. Kalgoorlie and Boulder again form nearly one centre 400 miles inland, entirely mining communities. Bunbury and Albany are small seaports on the south-west coast.

Altogether about 3,270 children were examined, distributed as follows:

	Girls.	Boys.
Perth	469 ...	563
Fremantle ...	305 ...	393
Kalgoorlie ...	218 ...	269
Boulder ...	204 ...	230
Bunbury ...	143 ...	176
Albany ...	144 ...	155

Only two of the available children were withheld from the examination by their parents. Willing co-operation was granted by the education department and its staff, and the work went very smoothly.

The detailed results of this examination are given in a report which was made public in August, 1907, and some of the points may be referred to. "The height and weight observations seem to show a higher standard at lower ages, ... 'probably due to more rapid growth at ages lower than those at which the observations were taken, the rapidity of increment not being maintained and falling below the English standard,' . . . . seeming to indicate an early forcing due to climatic conditions, which leads to no subsequent advantage."

In the eyes the usual proportion (apparently) of refraction errors was found. The examination only went as far as obtaining acuity of vision and differentiating the three errors of refraction by means of test lenses.

Some attention was paid to teeth, as being a matter in which Australia has a bad reputation. The number of permanent teeth present was recorded in each case, and the number of these which were carious. The figures showed again "the more rapid early development with no subsequent advantage"; but I was not able to obtain many from outside for comparison.

Of deformities, the only one of importance noted was lateral curvature of the spine, which was met with very frequently, more particularly among the girls (5 per cent.), but varying in different localities, being greatest on the Goldfields, 8·2 and 6·3 per cent., heat being apparently therefore one exciting cause, as it was least at Albany (1·4 per cent.), which was the coolest locality.

A few cardiac bruits were met with, for the most part probably of little significance.

Department of Public Instruction, Sydney.

Statement indicating what has been done, and is now being done, in matters relating to School Hygiene.

Appointment of Lecturer in Hygiene.—With a view to make the lessons on domestic economy more practical, especially in the direction of the feeding, nursing, and care of infants, Dr. Mary Booth was appointed in May, 1904, as lecturer in hygiene. Her duties are to deliver lectures periodically to the female training students, and to give lessons to the girls in the upper two classes of the public schools at times arranged by the Department.

Schoolroom Hygiene.—Schoolrooms are being gradually remodelled as regards furniture, lighting, and ventilation. Dual desks and seats are replacing the long desks and seats of the past; and furniture is arranged in the remodelled rooms so that the light falls on the left of the pupils. By means of movable glazed partitions, many schools are now so divided that there is a classroom for each class; and where necessary, by sliding back the partitions, two classes can be combined. Teachers generally are alive to the importance of fresh pure air in the schoolrooms, and the matter of ventilation is receiving special attention.

Medical Inspection of Schools.—During 1907, arrangements were made for the periodical medical inspection of schools. The work was initiated in the metropolitan district, but was soon afterwards extended to Newcastle, and the medical inspection of schools is contemplated. Two medical inspectors have, so far, been appointed: Dr. Reuter E. Roth for the metropolitan, and Dr. May Harris for the Newcastle district. The medical inspectors pay regular visits to the schools, and report upon their hygienic condition as regards light, ventilation, and drainage. They also medically examine pupils who appear to be physically or mentally defective, or who exhibit signs of ailments or defects.

Anthropometric Survey of Public School Children.

In connection with the medical inspection of schools, an anthropometric survey of public school children was initiated in May, 1907. The survey is being taken in Sydney and in various country districts presenting climatic, social, and physiographical differences. The work is being done mainly by the teachers, and 30,000 records have already been received. These records give particulars regarding the height, weight, and vision of pupils. The physical development of the children is being compared with their mental progress, and some results of a very interesting nature have been obtained. These results will be published by the Department when the scheme has completed its first year of operation.

SCHOOL HYGIENE IN TASMANIA.

By J. S. C. ELKINGTON, M.D., D.P.H.,

Permanent Head, Department of Public Health; and Officer Directing Medical Branch of Education Department, Tasmania.

THE Department of Public Health of Tasmania came into being on January 6th, 1904. One of the earliest matters to receive the attention of the new Department was the question of School Hygiene, this branch of sanitation appearing to be of somewhat peculiar importance under Tasmanian conditions. An inquiry into the general administration of the Education Department was on foot at the time, and by ministerial direction the condition of State school buildings *qua* hygiene formed a subject of special investigation. A report was presented, wherein it was found necessary to criticise strongly and adversely the existing methods of school construction, school furnishing, and school sanitary management, so far as they related to state schools, and to lay down certain principles for future guidance in such matters. This report received considerable public attention in this and certain other states.

The formulation by this means of a definite scheme of school construction and of school sanitation generally, served a useful purpose in that it removed the matter from the sphere of vague criticism and of antagonistic generalities on the part of opponents. The proof of the soundness of the general principles then advanced has since been afforded by the erection of new schools, placed and planned on effective sanitary and pedagogic lines, at no greater cost per head than those of the old insanitary pattern.

In 1905 the advent to the Directorship of Education of a modern educationist, alive to the educational and administrative advantages of school hygiene, enabled active measures to be taken in the direction of interesting and instructing teachers in the subject. A series of twelve fortnightly lectures was delivered to teachers at the Technical School, Hobart, by myself, a full syllabus of each being published in the official *Educational Record*. The large attendances and the interest displayed were very satisfactory. A series of "Talks on School Hygiene" was also contributed to the *Educational Record*, for the benefit of teachers residing out of reach of Hobart.

During official tours and at other times a large number of state schools were personally visited, and existing defects of sanitary construction or management pointed out to teachers. Care was always taken to indicate simple and effective means of remedying any defect capable of being dealt with by the teacher. The necessity for and method of removal of unnecessary frosting from windows; re-arrangement of desks to prevent front lighting and to secure left lighting; the allotment of children as far as possible to desks and forms of suitable height; the arrangement of desks and seating so as to secure proper distance and reasonably correct working posture; the detection and indication to the teacher of children with obvious defects of sight or hearing or advanced post-nasal growths; simple "dodges" for improving lighting or sanitary management; the superiority of damp cleansing as compared with dry methods; outlines of procedure for dealing with communicable diseases and external parasites; and similar practical matters of everyday utility were and still are brought home to many teachers in the course of these visits.

The official *Educational Record* is filed in each school, and thus the series of articles on school hygiene can always be made to serve as a text for remarks on the local environment.

During 1906 a training college for teachers was instituted in Hobart by the Education Department, and elementary school hygiene was placed in the curriculum as a compulsory subject. A series of lectures was delivered, and an examination at the close of the year showed that the trainees had profited by the teaching.

In the same year, with the co-operation of the Director of Education, strong representations were made to Ministers regarding the necessity for an extensive medical examination of school children with a view to ascertaining their general physical condition. The proposal was accepted, and during July, August, and September, 1906, some 1,300 Tasmanian children (1,250 in Hobart) were exhaustively examined by Dr. A. H. Clarke, Dr. W. Tofft of Campbell Town, and myself. The examination was based on that of the Scottish Royal Commission on Physical Training. The results were presented in a special report, and enabled certain very definite conclusions to be advanced in favour of establishing a system of medical inspection in the Tasmanian State Schools. The facts presented and representations made in this report were favourably regarded by Ministers, with the result that final approval was given to a scheme whereby one whole time and two part time medical officers were to be employed for the purpose of medical inspection of State Schools. The work was organised in the form of a Medical Branch of the Education

Department, of which branch I assumed charge at the request of the Minister of Education.

By interdepartmental co-operation of this nature mutual advantages were gained, in that the work of my own department was simplified and strengthened in several directions, whilst the Education Department was relieved from the control of highly technical professional officers for whom laboratory, library, and other professional facilities were at the same time provided. This arrangement marked the close of my own single-handed efforts in the professional cause of school hygiene in Tasmania, and brought to my assistance three excellent colleagues.

The new system commenced early in 1907 with the appointment of Dr. Gertrude Halley, M.B., Ch.B.Melb., as (whole time) medical inspector of schools, and of Drs. A. H. Clarke, M.R.C.S., and G. H. Hogg, M.D., as (part time) visiting medical inspectors for the city districts of Hobart and Launceston respectively. It was resolved for purposes of observation to try both of the methods over which so much controversy has raged amongst school hygienists in England concerning the whole time *versus* the part time medical inspection. It may not here be out of place to allude to the fact that some twelve months of working under this system in a small community has not brought to my notice a single instance of friction or difficulty between the medical inspectors and their fellow medical practitioners.

The duties are allotted as follows: Dr. Halley lectures on School Hygiene to teachers at the Training College; systematically visits schools outside the city districts for the purpose of examining into their sanitary condition and management; examines children for physical defects and advises teachers as to the methods advisable for mitigating or overcoming defects found; advises teachers in country schools on hygienic questions; collects systematic physical observations on State school children generally; delivers addresses to mothers on sanitary subjects, and assists the city medical inspectors when required.

The city visiting medical inspectors visit each school in their districts at least once weekly, and each class-room at least once fortnightly. During these visits they examine all new entrants, all cases submitted by teachers for medical examination, and such other children as they may consider to require it. They also instruct teachers (amongst other matters) in the methods of taking weight and height observations, and of detecting cases of communicable disease and other pathological conditions of importance from the school standpoint. The observations are recorded for future use, a card system enabling the physical characteristics of each child in the

city schools to be noted in permanent form, whilst a medical register is used for those who undergo examination for special reasons. Parents are informed by means of a printed notice (signed by the head teacher at the medical inspector's direction) concerning any condition found requiring treatment, and are advised to consult their own medical man. The necessary legal power to examine children is conferred by regulations under the Education Act. Objections by parents are very rare, and the notices appear to receive very satisfactory attention upon the whole. One encouraging feature consists in the number of voluntary applications from parents for the examination of their children by the medical inspectors.

A proposal was put forward in the 1906 Report concerning the advisability of communicating with the Governments of other Australian States and of the Commonwealth with a view to securing a sufficient number of comparable observations on school children in the various States for analysis and interpretation by the Commonwealth statistician, who is also a highly skilled educationist. The Tasmanian Government communicated accordingly, but the only other State willing to enter into the scheme was South Australia. The Commonwealth Government authorised the co-operation of their statistician (Mr. G. H. Knibbs), and it is anticipated that comparable observations on uniform lines will be commenced shortly in South Australia and Tasmania.

Certain interesting results may be quoted from the first six months' results of observation in country schools by Dr. Halley. Minor ailments and defects are not included.

Certain observations made during Medical Inspection for six months.

(58 country schools, 3,247 children examined.)

Defective eyesight	234	7·21	per cent. of total.
Defective hearing	212	6·53	„ „
Marked post-nasal growths, or much enlarged tonsils seriously interfering with respiration	373	11·49	„ „
Heart disease	28	·86	„ „
Mentally defective	24	·74	„ „
Epileptic	3	·09	„ „
Curvature of spine	6	·19	„ „
Chorea	4	·12	„ „
Anæmia, very pronounced	6	·19	„ „
Consumption	4	·12	„ „
Diphtheria	1	·03	„
	895	27·57	

The fact that no fewer than 895, or 27·57 per cent. of 3,247 children in the fifty-eight country schools examined were suffering from defects capable of interfering to a pronounced degree with their educational progress is very significant. I am not at liberty at present (pending a report now in preparation) to quote the figures for city districts, but they do not show by any means that these defects are confined to country children. These figures cannot be used to the detriment of Tasmanian children, as compared to those of other Australian States, as, so far as I am aware, no similar inspection has been carried out elsewhere for Australian country schools over so large a proportion of the school population. In practically no instance were the parents aware of these defects in their children prior to the medical examination.

The number of children in average attendance in Tasmanian State Schools (1907) was 14,464, distributed over 356 schools. The Parliamentary vote to the Educational Department for 1907–8 was £63,755. Another £9,030 was paid in fees during 1907. The fee system will be shortly abolished. The cost of the medical branch is estimated at some £500 per annum, including travelling expenses.

An outfit for the medical inspection work is supplied to city schools. This includes scales, height standards, clinical thermometer, basins, towels, etc. A first aid box, devised by Dr. Halley, has been supplied to some city schools, and it is anticipated that all will be shortly provided for in this way. Instruction as to the use of the equipment is regularly given. A portable medical inspection kit, including scales, height standard, etc., packed in a strong box for transit, is taken by Dr. Halley on her country tours. Cards, registers, and forms for use in the work were drawn up at the inception, and are kept constantly under observation for necessary alterations or amendments. The medical inspectors report to me at monthly intervals, any urgent matters being notified at once. A conference of the medical branch was held recently in Hobart for the discussion of various matters connected with the work. This will be made a regular institution, in order to secure systematic exchange and discussion of views for the benefit of the undertaking.

Efforts are being made to obtain the inclusion of elementary teaching of hygiene in the ordinary school curriculum, and when this comes about the work of the branch will probably be considerably strengthened. The training of city teachers to undertake the routine examination of new scholars has been a slow process up to the present, but by allotting such work to one special teacher in each school as a part of official duty, and checking the results at irregular intervals, considerable improvement is being attained.

An encouraging feature is to be found in a recent request from the governing authority of the Roman Catholic schools in Tasmania, that arrangements be made to bring their schools also under the State medical inspection system. Several large private schools have also applied for advice in matters of school hygiene and school construction.

In thus outlining the progress and present scope of the school hygiene movement in Tasmania I must disclaim any intention of holding up the undertaking as an administrative example to others. Much requires to be done before it can be regarded as complete, and only by careful observation and trial can the effect of new extensions of the work be gauged and justified. Nevertheless, it meets our Tasmanian requirements fairly satisfactorily, and forms, in point of time, I believe, the first instance of a comprehensive State system of medical inspection of schools in Australia. The principal difficulty met with has been the inertia of the teachers themselves in matters of school sanitation. This will, no doubt, be gradually overcome in time, particularly by the lectures to trainees.

GENERAL AND COLONIAL NOTES.

DISCUSSION ON SEWER VENTILATION AND THE INTERCEPTION TRAP.

See Journal for May, 1908, Vol. XXIX., No. 4.

The following communication has been received from E. MOHUN (Victoria, B.C.):—

This is a subject which strongly appeals to the writer, to whom it appears reasonable:

1st. That public sewers should automatically ventilate themselves, without having recourse to the private sewers and house plumbing for the purpose.

2nd. That the public sewers should be so designed that each short section becomes self-ventilating, without reference to those immediately above and below it, or in other words, that sewer gas should not be allowed to accumulate so as to find its discharge at a distant point, generally speaking in higher levels.

3rd. Common sense appears to indicate that, health being of primary importance, every precaution should be taken against the admission of sewer gas or disease germs, generated in the public sewers, to dwellings.

The writer has had the privilege of designing and partially constructing the sewerage systems of the City of Vancouver and Victoria, British Columbia, both on the separate system and discharging into the salt water by which they are largely bounded.

Other installations, public and private, constructed by the writer, have generally involved the use of the septic tank in connection with contact beds, or broad or subsoil irrigation. In all such cases, however, care has been taken to thoroughly disconnect the disposal plant and the buildings.

In the separate systems before referred to, manholes were placed at all changes of grade or alignment and very rarely exceeded 600 feet apart, and were all furnished with the usual perforated cover, beneath which was suspended a dirt tray.

Ventilators were provided at distances of not more than 300 feet.

To prevent the gas generated in one section finding its way to another, the inlets of sewers in the manholes were provided with rubber flaps, weighing $1\frac{1}{4}$ lbs. per square foot; the bottom of the flap was cut off, so as to leave a clear opening of one-fourth the diameter of the pipe it covered. They were secured above the crown of the pipe with two half inch bolts and nuts, the former built into the wall of the sewer. By these arrangements, each section, of about 600 feet, had two outlets for the gas generated in it, which it is believed achieved the desired result. Unfortunately, since the writer's connection with the work ceased, the City Fathers, having come to the conclusion that flaps were unnecessary, have removed them. Since their removal, there have been many complaints of noxious odours at the manholes.

It is obvious that it is far easier to ventilate a separate system of sewage,

such as that referred to, than a combined: and when designing this system in 1890, the writer held, perhaps erroneously, that while fresh sewage might be offensive to the sense of smell, poisonous gases were alone generated after decomposition set in; believing this, care was taken to render the sewers self-cleansing, and to discharge all sewage into the sea within twelve to fifteen hours after entering the sewer.

Within four years from the commencement of the work, the death-rate in Victoria was reduced from twenty per thousand to fifteen. How far this was due to the sewerage system is a matter of opinion, but at all events the fact is a gratifying one.

With reference to house drains and plumbing, the writer is an uncompromising advocate of the interception trap (with vent on the sewer end of it) on the house drain; and is strongly in favour of making the closet connections the only direct ones with the sewer, carrying up the soil-pipe full bore, well above the eaves or openings, if possible, outside the wall.

Sink and bath wastes, in the writer's opinion, should discharge, where practicable, in the open air over a combined gully and grease trap before entering the sewer; the waste pipes being carried up as directly as possible, full bore, as in the case of the soil-pipe.

No pipes of any description should be embedded in walls or floors, but where necessary should pass directly through them.

The foregoing shortly embodies the principles upon which the writer has endeavoured to act for upwards of twenty years, and which he earnestly desires to submit to the criticism of the members of the Institute, trusting that some new light may be thrown upon a question which, doubtless, is open to controversy.

An objection to the trap made by the Plumbing Inspector of this City was that it would be frequently choked with grease, to which, of course, the writer's obvious reply was, "Grease should not be permitted to enter house drains."

There is no more risk, under proper conditions, of an intercepting trap becoming choked than that of the closet or bath-room.

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SOME ASPECTS OF THE HOUSING PROBLEM & TOWN PLANNING.

By E. H. SNELL, M.D., B.Sc.Lond.,
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And J. E. SWINDLEHURST, M.Inst.C.E.,
City Engineer, Coventry.

Read at Sessional Meeting, Coventry, June 20th, 1908.

E. H. SNELL, M.D., B.Sc.Lond.

BY the Housing Problem I mean the problem of providing, or causing to be provided, good sanitary houses for the poorer people.

This problem has been with us for a long time, and will be with us for a long time to come.

It is a difficulty as yet unsolved, and one that calls imperatively for solution. Therefore there must be advantages in the discussion of the matter on every reasonable occasion. So that those who are in earnest in trying to find a remedy, may if possible concentrate their energies in the most profitable direction.

The first point that seems to arise is this: Has any progress at all been made in recent years in improving the housing of the poorer people? The reply to this question must, I think, inevitably be: Yes.

I have recently been re-reading the Report to the Home Secretary from the Poor Law Commissioners on an Enquiry into the Sanitary Condition of the Labouring Classes, which was presented to Parliament in 1842. That was the work of the late Edwin Chadwick, and at one time the standard work in sanitary science.

This report affords incontrovertible proof that we have at any rate

made great advances since that day, for no such report of the housing condition of the labouring classes could be written with truth to-day.

Truly we can point, and only too easily, to conditions which should be altered, but the conditions do not compare with the conditions existing in 1842.

Taking the one evil of overcrowding and examining the figures of the last two censuses, we find that of the urban population alone there were under overcrowded conditions at least 55,483 tenements and 341,414 persons fewer in 1901 than in 1891, representing a decrease of overcrowded persons from 12·31 to 9·07 per cent. This is an alteration in ten years, and took place in spite of the considerable increase which occurred in the urban population.

Taking the whole population, the decrease in overcrowding was from 11·23 to 8·2 per cent., or there were nearly 600,000 less living in overcrowded tenements in 1901 than in 1891.

It is unnecessary to attempt to show the direct relationship which exists between better housing conditions and a lower death-rate. During the past twenty-six years, the general death-rate of England and Wales has fallen from over 22 to 15 per thousand.

Probably consumption is more intimately connected with housing conditions than is any other disease: during the last half-century the death-rate from phthisis has fallen 50 per cent.

I think that we may conclude that some progress has been made in the general housing conditions of the poorer classes throughout the country.

And yet the housing problem remains with us. Conditions exist on all hands which we know should be altered: old, dilapidated, damp, improperly ventilated and lighted property still exists; and always good dwellings are slow to take its place. In a provincial city such as this, private enterprise is gradually meeting the demand for five-roomed houses let at 5s. 6d. and more per week; but practically nothing is being done to meet the requirements of those who cannot afford 5s. 6d. or more per week, and who could reasonably do with still smaller houses. The small two and three-roomed houses in courts therefore remain, and there is always a population ready to occupy them.

As to the most promising procedure for a municipality to adopt to improve the housing of the poor, in order to answer this point we have to trespass on debateable ground. But as debateable ground must be common ground we may be pardoned for trespassing.

(1) There are those who appear to think that the problem will be best overcome by the municipality undertaking the building of houses.

(2) There are others who think that the owners of unfit houses should be compelled to make them fit or to demolish them.

(1) The magnitude of the undertaking of the wholesale building of houses should be appreciated before it is entered on. There is a growing tendency to abhor monopolies in private hands. The result of this is that monopolies are being more and more municipalised. Water, gas, electricity, trams, and other similar undertakings, are on all hands being municipalised.

House building, however, will never be a monopoly, and under existing conditions municipalities can never expect to do more than a tithe of the house building that is done. It is far too expensive a matter.

In 1891 the total number of houses, inhabited, uninhabited, and building in this country was 5,862,068: in 1901 the number was 6,771,193, or there was an increase in the ten years of 909,625 houses, or 15·52 per cent. The increase in the population in the same time was 12·17 per cent., *i.e.*, the houses were increasing considerably more rapidly than the population. Not all, but nearly all, of the increase of houses was effected by private enterprise.

Mr. Nettlefold has pointed out the difficulties that exist in arriving at the real cost of housing and re-housing schemes; in order to show an apparent profit it is quite common for a portion of the cost of the land to be debited to some other account. He has collected the figures relating to 10,805 houses that have been dealt with under Part I. of the Housing Act, where the cost is clearly shown: these cost £4,202,655, 54,030 persons were re-housed, *i.e.*, at an average cost of £77 15s. per person.

He says: "It is, I think, understating the case to say that there are at the very least five million people in this country living in houses that urgently require improvement either in their fabric or surroundings. If the tenants were re-housed under Part I., at a cost of £50 per head, the total sum required will be 250 million pounds, which is far more than local authorities could possibly raise for housing reform, even if they and their constituents were willing to do it."

I think, therefore, that it will have to be admitted that local authorities will be able to do little more than build sample houses.

It is sometimes supposed that the local authority by building houses will be able to regulate rents. This they will never be able to do. The value of a house, as of any other commodity, always has been and always

will be the price that it will fetch, which is determined by the relation of supply to demand.

If the houses of a local authority are let at less than they will fetch, they are to that extent subsidised by the rates; the selection of those who are to be helped to house rent by the rates is likely to lend itself to abuses; and we are informed by the most able economists that a subsidy towards rents is merely a subsidy to the employers of labour, since wages will fall correspondingly.

In Coventry we have building at the present time by the Corporation some seventy houses of two classes. The houses of the one class are to be let at about 5s. 3d. per week, and those of the other at about 4s. per week. If these houses are superior to those provided by private enterprise at the same price, it will be possible for the Corporation to continue to let them at less than they will fetch. On the other hand, rents are high in Coventry at present. A time may come when this may not be the case. Instead of the empty available houses being counted by units, they may perhaps be counted by hundreds or thousands. This has occurred elsewhere. Rents will fall. Would the Corporation pursue the same policy of a fixed rent? The supposed fixed rent will have to come down or the houses will be empty.

I have always thought it reasonable to urge that a municipality desiring to attack the housing problem should do so at the bottom, by attempting to provide the smaller and cheaper type of house of two to four rooms; houses which are not being provided by private enterprise, and might be expected to be occupied by the present slum dwellers, who may be supposed to be unable to pay 5s. or 6s. per week in rental.

This, however, has not been the line adopted by most municipal house builders, and I know of no more convincing proof of the failure of municipal house building to deal with the crux of this question (the provision of houses for the *poorer classes*) than that wonderful collection of facts and figures given by Mr. Alderman Thompson, of Richmond, in his "Housing Handbook Up to Date."

An examination of the figures of that book will shew to what a very small extent houses have been provided at less than 5s. per week. The provision of houses at more than this rental is the doing of something which any ordinary builder can do, and there is no difficulty about it.

The houses erected by the London County Council are largely let at 8s. to 12s. per week, and go up to 14s. 6d. per week. At Richmond six houses have been erected at 4s. 6d., and 126 others varying from 5s. 6d. to 7s. 9d. per week.

I submit that this is no solution of the housing problem as I understand it—the provision of houses for the poorer classes.

The only town in England that I am acquainted with, which has done anything material towards the solution of this difficult problem by means of house building, is Liverpool.

Probably the provision of houses for the very poor will never be successfully accomplished until the still more difficult question of poverty is dealt with.

(2) Regarding the method of compelling owners to make their houses fit for habitation or to demolish them, this seems so simple, and to many so reasonable, that the question may arise as to why it has not been done before.

Since 1851 no fewer than 28 Acts of Parliament have been passed dealing in one way or another with the improvement of housing conditions. The Act of 1890 was a codification of previous Acts. Part II. it is which gives powers for dealing with insanitary houses. Quite a small number of towns, among them being Hull and Birmingham, have been successful with this Part of the Act in effecting any great and wholesale improvements in housing conditions.

What is the cause of the practical failure of this Act? I will suggest that the cause of failure lies in the delays and uncertainties involved in any procedure under the Act. Not only has the official adviser, the medical officer of health, to make up his mind concerning every house dealt with, but he has to consider the subsequent task, namely, that of causing his views to be accepted by no less than three lay bodies, any or all of which may be entirely unsympathetic in the work.

(*a*) There is first the sanitary committee and the council.

(*b*) There is a bench of magistrates in petty sessions, which bench is differently constituted on different days of the week.

(*c*) There is beyond this a right of appeal to quarter sessions, another body of magistrates drawn to some extent from rural districts, districts which are often not patterns of progress in health matters.

I venture to suggest that with such a series of tribunals for the machinery of Part II. of the Act, the owner of unfit houses has been protected to an extent which he does not deserve, and the traffic in slum property has been encouraged.

So long ago as 1842 the report to which I have already referred spoke of the unhealthiness of back-to-back houses: since that date it has been proved over and over again that the death-rate in back-to-back houses is higher than in through-ventilated houses; yet to-day, sixty-six years after

that report, I do not know any authority who would feel their powers sufficient (in the absence of some local Act) to close a back-to-back house when this was the only defect.

Up to quite recent years back-to-back houses have been permitted to be built in certain towns.

Is this condition of affairs to remain? I think not. The Bill now before Parliament is probably not the last Housing Bill which will be necessary; but I think it is clear that it is likely to produce enormously good results.

That part of it relating to unfit houses gives to the Sanitary Authority the power to make the closing order. There will be no appeal to Benches of Magistrates; but the British love of appeals would be badly hurt if no appeal had been arranged for: the appeal provided is to the Local Government Board, and as that Board has expert sanitary advisers it may be expected that that appeal may afford every reasonable protection to the owner of insanitary property.

It will be seen that if this Bill passes in its present form the question of dealing with unfit property will lie entirely with the ratepayers; it will be for them to select a Council who desire unfit property to be improved or to disappear; and for that Council to select from its number those who are the most capable of dealing with the matter and to constitute them the Sanitary Committee.

As the health of one class of the community affects in the long run the health of all classes, any simplification in the procedure involved in the mitigation or removal of insanitary conditions must have a tendency to promote the social well-being of the whole nation.

J. E. SWINDLEHURST, M.Inst.C.E.

A CONSIDERATION of any phase of the housing problem, and the provision of suitable and proper dwellings for our town population, leads naturally to a consideration also of that further important aspect of this great question comprised in the planning of our towns.

A good deal has been written and said in recent years on the subject of town planning. Slowly but surely the public sense is being aroused to the fact that not only is it necessary to provide houses which in themselves

may be reasonably sufficient, but equally that the environment of our dwellings may be rendered such as to add still further to the health, comfort and enjoyment of the inhabitants.

Much practical good has already been achieved in this direction, and a visit to any of the modern examples of "garden cities" in this country will amply demonstrate that it is possible to build small houses, and at the same time to render their surroundings attractive and beautiful, and thus to effect a great improvement in the present methods of laying out our streets and building estates.

As to the great desirability of all this, I believe there is a decided unanimity of opinion in favour amongst all who have studied the question, and hence I do not propose to pursue this aspect of the matter further.

It is, however, an easy thing for a philanthropic landowner, or a combination of public-spirited individuals, to embark in a speculation, and to lay out and develop an entirely new area, and, untrammelled by existing buildings or physical obstacles, to form a beautiful "garden city" which shall be practically self-contained.

Unfortunately, all landowners, much less land speculators, are not philanthropists; some of them have no public spirit whatever, and most of them are men with a keen eye to the business side only of the scheme upon which they embark.

Those of us who have to deal with the extension of rapidly growing towns, appreciate very fully the greater difficulties which, under present conditions, confront the local authorities in the attainment of even very moderate schemes for town improvement, whether in the built-up area of the town itself, or in the undeveloped land in the suburbs.

Experience is worth much precept; it is my object to deal only with a few points in the severely practical aspect of this question which confronts us, in common with other towns, which may be developing rapidly.

During the last few years the City of Coventry has, fortunately, been experiencing a wave of great commercial prosperity, due largely to the development of the motor car industry, as well also as to the introduction of other large and important industries.

The usual result has followed, and, owing to the great influx of workers from other places, the provision of additional housing accommodation has been very pressing.

In consequence of this, much land has been brought into the market, and laid out and developed for building purposes. Land, which four or

five years ago could only be considered as of agricultural value, has suddenly ripened into building land, and been sold at greatly increased prices. This expansion has taken place on almost every side of this city.

The population of Coventry at the last official census was 69,877 (1901). To-day the population is estimated at 91,000 persons, a total increase of 30¼ per cent. in seven years. This rapid increase has, as I have stated, led to much land being laid out for streets and building sites.

During the last ten years 44 estates have been, or are in process of being, laid out within the city. These estates comprise, in the aggregate, an area of over 319 acres, with 119 new streets, having a total length of about 15½ miles. But by far the major portion of this extension has really taken place within the last four years—since 1904.

During this latter period the proportion of the above total has comprised 30 estates, having an aggregate area of 296 acres, with 91 new streets, having a total length of nearly 12 miles.

Now in order to enable you to appreciate the real nature of the problem with which we have been confronted, I must explain very briefly the sequence of events which takes place in the planning of these estates.

For the most part the land which has been laid out and built upon has been agricultural land, allotment gardens, etc. Seven years ago he would indeed have been an optimistic person who had ventured to forecast that in 1908 this land would have been laid out in streets, and for the greater part built over, so rapidly have events moved.

The land has been acquired, for the most part by private speculators, in plots varying from about two acres, to between 30 and 40 acres.

Some of these estates have, I am pleased to say, been laid out on lines which leave little to be desired: the number of houses in certain cases being only seven or eight to the acre. Wherever this has been done the houses are, of course, of a superior kind, at comparatively high rentals.

In many other cases the areas have been laid out for the erection of a good type of dwelling, having ample space at the rear, and in most cases with a small forecourt, which also leave very little to be desired.

In some cases, however, the areas have been laid out essentially to meet the incidences of the particular area, and in most cases quite regardless of the amenities of the locality, but rather, it would seem, to make the very most of the land from a speculator's point of view.

On many of these areas 30 houses to the acre have been erected. In some cases as many as 35 or 36 houses to the acre. Needless to say there

is very little of the Garden City element where this happens, and, unfortunately, it is by no means uncommon.

The practice of laying out small estates belonging to different owners, and often adjacent to each other, as also to larger areas of undeveloped land which will shortly have to be dealt with, creates the greatest amount of difficulty from the authorities' point of view. Districts cannot possibly be laid in this piecemeal and haphazard fashion, except at the sacrifice of much more material interests, and this is precisely the experience we have had in this city in recent years. We have found the greatest difficulty in co-ordinating the planning of the estates and reconciling the interests of the several owners, so as to obtain anything like a systematic and well planned area.

In some cases a large area of land has been split up into "lots to suit purchasers," and sold without any reservation whatever, leaving it to the individual purchasers to develop their portion as their wisdom dictates.

I have always considered it in the highest degree unfortunate that the owners of comparatively large areas of land, when deciding to put such land into the market, have not first developed a plan on broad lines for the laying out of the whole area, having regard to the surrounding conditions of the locality, as well as to the particular area concerned.

In this manner landowners could render great service to the community at large, and would greatly aid the efforts of the Corporation to secure a well-planned district, nor do I think that such a process would in any way detract from the value of their land. On the contrary, I am quite sure that in certain cases it would have avoided considerable difficulty and delay, and enhanced the value of the land.

It is fair to say that when laying out certain estates, some landowners, profiting by experience, have submitted tentative plans to the Authority, and invariably with good results.

Taking the recently developed estates as a whole, I believe that reasonably good results have been attained, but I am equally certain that, looked at from the point of view of the community, much better results could have been achieved if the authority had possessed further powers for dealing with the matter.

We have in many cases succeeded, by a process of negotiation and give and take, in obtaining small concessions, but there are obviously reasons why an estate owner is not willing to sacrifice a material portion of his estate, even in the best public interest, without a reasonable *quid pro quo*.

In almost all cases where estates have abutted upon existing roads, we

have, by friendly negotiation, effected a widening and improvement of such roads, and secured, on terms, the land necessary with this object.

During the last four years we have had twelve applications for sanctions for loans before the Local Government Board in connection with road widenings opposite new estates, and in every case we have met with a ready consent.

I have endeavoured to indicate briefly, and in very broad outline, the nature of some of the difficulties which have beset us in the last few years. It will be interesting to consider how far the provisions of the Housing and Town Planning Bill, presented to Parliament by the President of the Local Government Board, would have met the conditions with which we have been confronted.

It will be noted that under clause 45, sub-section 2, of this Bill—

> "The Local Government Board may authorise a local authority within the meaning of this part of this Act to prepare such a town planning scheme with reference to any land within or in the neighbourhood of their area, if the authority satisfy the Board that there is a *primâ facie* case for making such a scheme."

Let us see how such a condition would meet the case of Coventry.

Five years ago the city was progressing at a purely normal rate. So far as we on the spot were aware, there was no reasonable ground to suppose that we were within measurable distance of a huge development; and I think it is extremely doubtful if, under the then prevailing conditions, we could have satisfied the Local Government Board that we possessed a sufficient *primâ facie* case for town planning as set out under the provisions of the Bill.

Suddenly a large new industry was established in our midst, and within a short time was employing 2,000 men.

Shortly afterwards, the motor car industry began to show signs of activity, and developed with such rapidity as to require a great many more workmen than Coventry could provide.

There was, therefore, as I have before stated, a large influx of workmen from other towns.

Under these conditions we should have been able to show a very real and urgent case for town planning, but the development was sudden and unforseen.

Even if this Bill had been law, and we had had to proceed under its provisions (Sec. 47, sub-sec. 2) with the object of "securing co-operation

on the part of the local authority with the owners and other persons interested in the land proposed to be included in the scheme at every stage of the proceedings, by means of conferences and such other means as may be provided by the regulations, and also for dealing with other matters mentioned in the third Schedule to this Act," I ask, what period of time would have elapsed before we had a town planning scheme approved, and in operation? But meanwhile, the case was *urgent*.

I submit to you the question as to whether it would not be desirable to make it imperative upon all towns to lay down such a scheme in broad outline, so far, at least, as relates to the main lines of communication, and the ear-marking of open spaces for parks, playgrounds, etc., and the reservation of probable sites for other future public purposes.

Though under exceptional conditions it is possible to accomplish all that is essential in town planning without any special powers whatever.

It was my great good fortune some years ago to be officially connected with the town of Barrow-in-Furness at a time when it nearly doubled its population in a comparatively few years. This town is one of the best laid out and up-to-date manufacturing towns in the country. A town without a slum in its whole area. Some of its roads are 100 feet in width. One road, over three miles in length, is 80 feet wide, with trees planted along its whole extent. Other of its roads are 60 feet wide, and none of its modern streets is less than 40 feet wide.

Some of these roads were actually constructed, and others which have not yet been carried out were planned on paper long before the actual requirements of the case really demanded such roads, and I well remember in certain cases the usual plea of extravagance being urged against the Council.

Yet there is probably not a person living to-day who would now say that the men responsible for this had not done their work boldly and well. They simply took time by the forelock, and adopted years ago what the present day conditions are now demanding, a comprehensive system of town planning in its main essentials.

All this was accomplished by the rare combination of a beneficent noble landowner (the then Duke of Devonshire), public spirited companies, and a progressive and far-seeing corporation.

How far such a result could be attained in towns not so favourably circumstanced, is a matter for conjecture.

If it be conceded that a broad outline scheme of town planning is desirable, it should, in my judgment, be in existence, before it is actually

required to be proceeded with: it is not material that its development may be slow.

You would then at least be able to proceed on safe lines, and in the full assurance that although carried out piecemeal, and as the circumstances demanded, yet the process would presently develop into a perfect and comprehensive whole.

This is what Coventry requires, and what, I believe, most progressive provincial towns really require.

We want the power to project main lines of roads and arterial communication, to ensure that these shall be of such a width and so placed as will serve for the probable ultimate future development of the town in its truest interests.

We want power to supervise and direct persons laying out new estates, and to second their efforts in the right direction, and so secure a compliance with our broad general scheme of development.

We ought, I am sure, to welcome and be grateful for any powers to be conferred by the present Bill in this direction. The matter is difficult, and in some of its aspects highly controversial, but these questions may with confidence be left to the higher powers.

The probable necessities of any town in its broad aspects must of course have regard to its geographical position relative to neighbouring towns, and to the community of interests within its boundary.

Local conditions are usually well understood on the spot, and it ought not to be difficult, with reasonable foresight, for local authorities to provide for future possibilities.

Under Section 45, sub-section 5, of the Bill,

> "A town planning scheme may be varied or revoked by a subsequent scheme prepared and approved in accordance with this part of this Act, and the Local Government Board, on the application of the authority responsible for the execution of the scheme, or of any other person appearing to them to be interested, may, by order, revoke a town planning scheme if they think that under the special circumstances of the case the scheme should be so revoked."

Such a power is undoubtedly necessary in connection with any town planning scheme.

We have recently had experience in this city of a loop-line railway, for which an Act was obtained notwithstanding the strong opposition of the Corporation, which has materially interfered with estates in progress of development and with the amenities of the locality.

I have known a case where the removal of a railway station from one

side of a town to the other has changed the whole aspect of a large part of the town and its business centres. It is obvious that such contingencies may at any time arise, and in such cases the smaller interests must, of necessity, give way to the greater.

With such power vested in the Board it does not seem quite clear why in the second schedule of the Bill (16) a "Limitation of time for operation of scheme" should be needed.

Time will not permit of a review of the provisions of this Bill in detail, and, even if it did, it would be somewhat difficult, having regard to the questions left in abeyance (and to be dealt with by subsequent general provisions prescribed by the Local Government Board on the subjects as set out in the second and third schedules of the Bill) to express any decided views, until such provisions are forthcoming.

We are frequently told that the necessity for town improvements and street widenings is a reflection upon the foresight of former generations, and it is pointed out that many millions of pounds have been expended in such work which would otherwise have been saved, but I doubt if such an argument is just when applied to old cities.

Take our ancient city of Coventry, in mediæval times one of the largest cities of the country. At its foundation it probably embodied all that the knowledge and skill of the period thought necessary, and for hundreds of years after. Surely our splendid churches and ancient buildings are a sufficient monument to the public spirit which then prevailed.

Coventry was built at a time when it was imperative for the public safety for cities to be enclosed, and this fact accounts for the narrow streets which you find in the centre of our city.

Judged in the light of the present requirements, our narrow streets are much to be regretted, because financial considerations alone render an amelioration of the present conditions all but impossible.

But herein also lies the moral, and if we are not to have a repetition of this state of things in the districts we are now developing, it is imperative that we should legislate on sufficiently bold and broad lines to serve, not only the present, but also the ultimate requirements. This, in my judgment, constitutes the very essence of town planning.

It will, indeed, be deplorable if any modern town a few generations hence finds itself in the position of having to spend large sums of money in undoing what is being done to-day. Yet I fear there is a distinct danger that we may be laying up a legacy of trouble for the future, and

why? Certainly not because the governing authority of this city is lacking in foresight in these matters. On the contrary, we fully recognise the necessities of the case, but we appreciate also its limitations.

Dr. John Robertson (Birmingham) opened the discussion. He pointed out that in the manufacturing towns of this country the conditions under which a large number of the people lived were so depressing and unpleasant as to undoubtedly exert a baneful influence on the general health of the people living in those districts. He believed that it was possible to have this baneful influence in the centre of large towns even where the houses were relatively new and built under existing by-law systems. The point which he wished to emphasise was that model building by-laws alone could not meet the requirements of large towns. It was, therefore, necessary to have what has been called town planning regulations, so as to provide for the dwellers in the centre such surroundings that they might be able to live and rear families in moderately wholesome surroundings.

The pleasantness of many of the German towns was due entirely to foresight in planning the areas before they were built or in reconstructing the old areas which had to be rebuilt, and while in many of these towns the house conditions were extremely bad the surroundings were good.

In addition to the necessity for power to plan out the growing area of a town, and possibly by-and-by to re-plan the bad parts of the centre, it was desirable that towns should have a much freer hand in purchasing land. Such purchase was essential if the manufacturing interests were to be guarded. Cheap land was equally essential for the building of working-class dwellings, and certainly town ownership was one means of preventing land speculation, which was one of the stumbling-blocks connected with the housing question in town areas.

Mr. G. S. Poole (Coventry) remarked that the great thing to be done to improve the social conditions was to improve the housing conditions of the workers. They could not have an intelligent democracy brought up in the slums. He was delighted to think that people of all classes were anxious to consider this question and provide remedies. The question was not whether progress had been made, but whether sufficient progress had been made. They knew in Coventry progress had been made, and slums had been improved. But they had not progressed in anything like the degree that they might have expected in view of the increased enlightenment of the times. This was largely due to the permissive character of housing legislation, and to the presence on the local councils of slum

owners, and other interested parties. Owners of slum properties should be treated in the same way as purveyors of diseased meat or adulterated food.

Mr. M. K. Pridmore (Coventry), Chairman of the Council Housing Committee, gave an interesting account of the progress of Coventry's housing scheme. They were fortunate enough to find land in the possession of the Corporation which had been bringing in very little indeed, and the Housing Committee had taken it from the Corporation at a fair market value. They had not aimed at putting up houses as cheaply as possible, but to erect comfortable dwellings at reasonable prices. He could not see how anyone could build cheaper houses than those the Committee had erected. The main thing they wanted to do was to remove the slums, and the first difficulty was that they had not sufficient power from Parliament, and that they had to turn out tenants without being able to provide accommodation for them. So far as those people who could afford to live in better houses were concerned, he had no sympathy with them, and they could not assist them. But there were some of these citizens who, through no fault of their own, could not afford to pay higher rents, and he thought it was a perfectly fair proposition to find these with houses. The benefit to the city in clearing out a slum would be immense, and it would be better to find these people houses rather than force them into other slums. They were trying to work the scheme on sound financial lines, and on conditions which, whether they were Socialists, Conservatives, or Liberals, they could not find fault with. If the scheme turned out a success and they gained the knowledge they wanted, then he hoped they might go further and attack the larger problems which lay before them, aided by larger powers from Parliament.

Alderman A. Park (Stratford-on-Avon) said that in tackling the difficult question of the improved housing of the working classes, the problem that appealed most forcibly to him, as representing a small town in an agricultural district, was one which was alluded to by Dr. Snell, but one which he aptly said had not been generally faced by public bodies. He meant the problem of how they were to supply the much needed want of decent and sanitary dwellings for men whose wages ranged from 15s. to 20s. a week. The dwellings that had hitherto been supplied by public bodies in most cases were confined to those with rents of from 5s. 6d. a week upwards.

Now that class of dwelling for the most part had been found to be one that could be and was built by other than public bodies to pay a reasonable interest on capital. But with regard to the class of dwelling he was referring to, in spite of much advertised building exhibitions, it was proved beyond doubt that no ordinary labourer could pay in rent such a sum as would return a reasonable interest on the capital expended in putting up and maintaining a new building.

In other words, commercially labourers' cottages did not pay. If they must be erected the loss must fall on owner or ratepayer unless they looked to the national exchequer.

The owner, unless a philanthropist, had given up building. The speculative builder, for very good reasons, refused to entertain any such scheme, while the local authority in the great majority of cases had, with the terror of increased rates in front of them, neglected to move, and yet it appeared to him that it was to the local authority they must look to solve the difficulty.

It savoured of socialism, and would therefore no doubt commend itself to Mr. Poole, for after all what was it but that A was to benefit B with capital derived from the pocket of C.

Be that as it may, at Stratford-on-Avon they had pretty well determined to venture on the experiment and see how it worked. It would be on a small scale of course to start with, and he was afraid they could not look for any but the most indirect returns to recompense them. These might be found probably in the long run in some diminution in the death-rate by the abating of overcrowding, and perhaps by thus raising the standard of the working man's dwelling they might influence to some extent the poor rate.

Dr. Snell mentioned in his paper that in the opinion of well known economists what they proposed to do (that was to provide houses at rather less than their actual cost) would lead to a reduction of wages, and thus put money into the employers' pockets. Of this he was not afraid, as their proposal was not a general reduction of rents, but the supplying of a more sanitary and better planned house at the same rent which the labourer was at that present moment paying.

Mr. Councillor Gardner (Chairman of General Works Committee, Coventry) welcomed the Town Planning Bill, and expressed confidence in the earnestness and the good intentions of the President of the Local Government Board in introducing it, but acknowledged disappointment in what he conceived to be the practical application of the measure, although the provisions to be included in the Bill, and only indicated in the schedules, might considerably improve it.

Clause 45 showed three serious weaknesses. The adoption of the Bill was optional; it encouraged piecemeal planning instead of complete planning to be executed as circumstances permitted; it authorised dealing only with estates possibly to be developed instead of immediate preparation ready for development now or in the future; and Coventry's experience had been that developments were so sudden that serious delay to everyone concerned would result.

He considered that ten per cent. for compulsory purchase now existing under

the Public Health Act, the powers of which Act the new Bill adopted, should be abrogated.

The Bill indicated that a scheme of town planning must be accompanied by plans and estimates, and would be subject to a time limit. Correct estimating was practically impossible, while the completion inside a given time would force expenditure to be made which circumstances would well permit to be delayed.

The idea of Conferences as expressed in the Bill, however well in theory, would not assist in early settlements. Mr. Burns laid it open for not only the local authorities and the owners directly interested to have their say, but "the ratepayers, the artist, the architect, and the engineer would have power to make representations."

Mr. Gardner asked upon whom the cost of roadmaking would fall; that was a serious matter, and the Bill was silent respecting it.

He suggested that a Town Planning Bill should empower a local authority to immediately prepare a scheme for its whole area, and, if necessary, for any additional adjoining districts by agreement with adjoining local authorities; that it should then await developments, carrying out its scheme just as fast or as slow as developments came along. The knowledge that certain portions of land were earmarked by a local authority who were waiting their owner's time to move, and not themselves hustling things to completion within a time limit, would bring land in at a reasonable price, while, if necessity dictated it, the local authority could urge the price, but must be prepared to pay if they did.

DR. F. E. FREMANTLE (Hertfordshire C.C.) wrote: Mr. Swindlehurst's interesting paper shows the need for an extension of building bye-laws so as to limit the number of houses to be erected per acre. At Letchworth the maximum, and that only in a small area of the city, is twelve to the acre. The ideal to be arrived at, as the poorer classes acquire the practice of gardening, is four to the acre. The Garden City Association expresses no view for or against taxation of ground values, but any taxation of land must inevitably tend to discourage the use of gardens; although the alternative scheme of rating land would not necessarily involve the same disadvantages if it only meant a transference of part of the rates from the house to the land.

Town planning is still in the nursery stage, and would afford a great scope for help from the Local Government Board, with its large field of experience and large command of expert advice. But the Board can only undertake this work, with the promptitude desirable, if relieved of much of its detailed work which can be equally well done by bodies of smaller experience. A policy of decentralisation is therefore advisable, whereby the primary supervision of rural and small urban work should be undertaken, with appeal and control to the Board, by the County Councils.

The Garden City Association is entirely in favour of the principles of town-surveys and standing schemes of development proposed by Professor Patrick Geddes and endorsed by Mr. Swindlehurst.

It must be borne in mind that modern development takes place along lines of communication, and that in many rural districts development of this sort is essentially of a nature to be supervised by County Councils. The growth of long lanes of houses with knots of buildings at intervals, shooting out over a radius of fifty miles from London, and in lesser degree from our other great towns such as Birmingham, is always to be borne in mind. A conspicuous instance is the scene of John Gilpin's famous ride from Edmonton in Middlesex to Ware in Herts.

As regards Dr. Snell's paper, all will candidly agree that the problem for the municipality is the problem of the poorer houses. But it is not sufficiently realised that the age of a house, as of a man, is limited; that during its life it undergoes degradation, and that the oldest and worst houses will, *cæteris paribus*, be always occupied by those to whom every penny of expenditure is of pressing importance. The permanent solution of the problem can only be found in the building of houses at an economic rental, that is, of 3s. 6d. to 5s. per week. To urge people to occupy these houses must involve a general rise in wages in proportion to the rise of sanitary requirements. It can only be secured, not by the erection of houses at the expense of the rates below cost price, but by firm action against overcrowding, by repair and closure and demolition, and by amendment of the laws to this end.

CONGRESS AT CARDIFF.

INAUGURAL ADDRESS

By The Right Hon. THE EARL OF PLYMOUTH, P.C., C.B.,

Lord-Lieutenant of Glamorganshire,

PRESIDENT OF THE CONGRESS.

Delivered July 13th, 1908.

THE old adage, which tells us that "Prevention is better than cure," is a mere commonplace, but it is the point upon which I want to lay special stress to-night in the words that I have the honour to address to you as President for this year of the Congress of The Royal Sanitary Institute.

Bearing in mind the enormous and ever-increasing yearly sum which is collected and spent in the cure and mitigation of disease, for the support of hospitals, convalescent homes, etc., and by legal enactment in dealing with diseased persons, I wish to lay particular stress upon the necessity of laying the foundations of such a permanent amelioration of the conditions of life in our country as will strike at the very root and origin of disease, and will place within reach of our ever-increasing population that greatest security for future health and well being which can only be found in the bringing up of our children in a reasonably hygienic manner, and thereby giving them the best possible chance of defending themselves against the attacks of those armies of microbes which modern science informs us are lying in wait for us in all directions, ready to devour us at any favourable moment.

Whether modern science is altogether wise in this candid proclamation of its knowledge I know not. The answer would probably be that it cannot well help itself. But it is hardly the common practice of doctors who, in dealing with their patients, often think it their duty to keep them in the dark as much as they can.

I once was responsible for the ventilation of a public building, not as an expert, but as the person to be hung, drawn, and quartered should any one suffer from my supposed negligence, or, by the way, by reason of my

being misled by experts, of course, a very uncommon occurrence, but may I say a possible one? Various tests were made of the condition of the atmosphere in different parts of this building; but as many persons were compelled to pass a good many hours of the day within its walls, I took very good care not to publish the results of these tests before the remedies recommended to me by my experts had been applied. For so it is, I believe, that we are apt unduly to alarm ourselves at the sight of a bacillus under a microscope, forgetting for how many years we have lived comfortably and fairly successfully in ignorant contiguity to these unwholesome creatures.

There is, I think, no theme of which one can say that it is as important as that of sanitation, for it means not only the well-being of the body, it means also the comfort, the happiness, even the sanity of the people; upon which it may be said that the power, nay, the very existence of a nation depends. Abolish illness, deformity, and weakness, and you go a long way towards abolishing crime, immorality, and all the evils these bring in their train. The greatest factors in sanitation are pure and plentiful water, fresh air, much daylight, and good artificial lighting; and to procure all these in abundance at the cheapest possible rate, and in the simplest way, is the task set to modern science.

The most urgent need is to put sanitation within the grasp of *all;* and in order to make the very poor, the ignorant, the indolent, and the indifferent profit by it, it is necessary to bring it to their homes in the simplest form, in such a way that it gives them no trouble whatever, and moreover to make it difficult for them to waste such precious things as water, fuel, and artificial light.

A very cheap and good lighting of the houses of the poorer classes would not only mean that they would be able to work more and for a longer time, and thus earn a better livelihood, but it also means abolishing dirt and many other evils which only thrive in darkness. We hear so much of the microbes in our days, to which I have already referred, and of all the complicated systems and inventions to keep them at bay. As things are, these systems and inventions are unfortunately necessary, but they ought not to be so, as the attitude of our minds and the resistance of our bodies ought to be such that, by leading healthy lives in healthy surroundings, we could defy microbes and banish them from our consciousness.

The first aim of those who love humanity and wish to see their country stand great and fearless amongst the nations of the world is to create a strong, healthy, and fine race, which can only be done by giving the

children good and adequate surroundings in addition to good food and proper clothing. Provision ought to be made in all newly built houses for open spaces, either covered balconies or loggias on every floor, in order that the children might play in the open air without having to descend into the dirty street. The women of the family could sit and work there, and in the summer it might be used as a dining room. In Southern continental cities such loggias exist in many of the houses, but they were closed up in the days when the population increased in the towns, and were made into rooms. Now that the laws and the importance of hygiene are beginning to be recognised everywhere, many houses, especially those of the working classes, are again built with an open space on every floor between every set of rooms. These open spaces also provide a place to air the bedding and clothes of the family, a process which everybody who has ever taken an early morning walk in a city abroad is well acquainted with, for in summer and winter the bedding is hung out of the windows, even by the very poorest. This is a most hygienic habit too much neglected in England.

There is no doubt that light has a most beneficial influence on the development of children. Tuberculosis and many other diseases grow and thrive in darkness, and in a country like ours, where every hour of daylight is necessary and every ray of sun precious, all means ought to be taken to let as much of them as is possible into our houses. Not only ought the use of unnecessary curtains and hangings before the windows to be discouraged, but the windows themselves should not only be *large*, but set out nearly flush with the outer wall, so that the light should not be curtailed by the surrounding stonework. In former days, when glass was expensive, there might have been some reason for protecting it by setting the window deeply into the wall, or it may have been merely the survival of the deep stone mouldings of gothic architecture, in which it was difficult to do anything else than to set the glass back.*

But these reasons exist no more. Besides which we must not forget that beauty also points in this direction, and beauty ought always to go hand in hand with perfect hygiene.

No one who has studied the domestic buildings of the sixteenth and seventeenth centuries can fail to appreciate the lightness of effect and the distinction which is given to the architecture of that period by the setting of windows nearly flush with the outer surface of the wall. Take for instance Wolvesey Palace at Winchester (in the grounds of which a mag-

* In London there was an old law, passed after the great fire, which provided that all woodwork should be set back at least 4½ inches from the surface of the wall.

nificent pageant has just been held) of the date, I think, of 1682. Or take an example much nearer home, Tredegar Park, a most beautiful example of Charles II. architecture (and there are many others that anyone in this hall might name). In like manner no one who has lived *in* such houses can fail to appreciate the added comfort and light derived from the window seats and sills from the interior.

For the perfection of sanitation we must adapt our rules and regulations to suit the climate, the situation of the house, and the life of the people who live in it. One of the greatest difficulties in the way of erecting cheap but healthy cottages with low rents has been the want of elasticity in the rules and regulations made by local authorities which, however well suited to urban districts, are not equally applicable to sparsely populated places.

Because drains laid in a certain way are quite successful in one house there is no reason why they should necessarily do as well in another, or that chimneys which draw well in one place should do the same a quarter of a mile away. It is individual cleverness and quickness of observation based upon the already accumulated science which will one day bring our habitations to perfection.

Sanitary conditions of life, especially for children, are more required now than ever they were before, as the early age at which they are sent to school, and the mass of (often quite useless) matter which their poor little brains are required to assimilate, together with the many hours during which they are condemned to sit in cramped positions, breathing the air so many lungs have already used, must necessarily stunt their growth and handicap them physically for the battle of life. I believe that it would be much better for the development of the race if children of tender age were taught to use their hands more and to tax their brains less. Learning crafts, even of the simplest kind, would develop their brains in a healthy manner, and moving about in well ventilated workshops would tend to rear children physically much more capable of acquiring and assimilating knowledge derived from books, and to do so in a much shorter time than is required under the present circumstances. We should hear no more of weakly boys and anæmic girls of fifteen and sixteen who cannot do anything, and end by swelling the ranks of the unemployed. Again, far too little attention is paid to the clothing of children. If they moved about in the fresh air as they were meant by Providence to do, it would be of less consequence, but herded together in schools where they often arrive hot, or wet from rain, they sit for hours in cramped positions which must make the blood stagnate, with cold feet,

breathing the air charged with the emanations from these damp and often utterly unwashed and unwashable clothes, whilst it would be quite easy to provide that children must in summer wear cotton or linen garments, and in winter woollen ones, made in such a way that they can constantly be washed.

In Germany I am told children are forbidden to wear high collars in school because these press upon the veins of the throat and very materially affect the eyesight. There are, I believe, schools where the schoolmaster or mistress passes under revision the whole of the dress of the children to make sure that their armholes are large enough, that the waist bands are not too tight, or the shoes not too short. These examinations ought not to be exceptional, they ought to be the rule, and they ought to go even further, for we do not want a race of learned weaklings, we want sturdy and healthy men and women, capable of coping with the difficulties of life; we want a practical, energetic, happy generation that enjoys work, loves and understands it, and will in its turn produce normal and healthy children.

The foundations of the prosperity of a nation are laid by home life, and all the outward conditions of this home life ought to be made as favourable as possible, but we have at the present time, in the main, substituted schools for this home life, and we see the deplorable results in all countries by the deterioration of the race and consequent inability to earn a living. We must, therefore, until a time comes when a wiser generation will make schools a supplement only to home life, and not home life a supplement to schools, concentrate our efforts upon making school children as healthy as possible. The schoolmaster and mistress ought to be thoroughly grounded in hygiene, and if in schools, instead of losing time by teaching children things that can never do them any good at an age when their little brains ought to be left to natural development, half an hour every day was devoted to hygiene, it would be some help. The master or mistress would examine the children, looking at their eyes, their ears, their teeth, their hair, their heads and feet; see how they hold themselves, how they walk, and impress upon them a few simple rules of cleanliness, such as their intelligence can grasp. These rules would soon become habits with them, and would in later life be far greater assistance to them than the useless book lore with which we now fill and paralyse their heads.

The object of life is to be happy and to make others happy. The true basis of happiness is health. A healthy people will work, and serve themselves and the community. Health and work insure morality. It is not

a question of making rules and inventions to heal and cure, the real issue is to make the conditions of life such that disease, deformity, weakness should no more exist. This may appear an unattainable ideal, but many things have seemed impossible and yet they have come to pass, and have established themselves, because we discovered the laws of nature which governed them. Many far more wonderful things will come in the near future, things which fifty years ago would have been considered miracles. Why should it be impossible to impress upon a nation a thing which only depends upon its own will and intelligence, a thing which leads to individual and collective happiness? For the older generation, brought up in ignorance of simple laws, in whose brains the useless matter accumulated when they were children stagnates through a lifetime, it is useless to try a reform, but for the young lives which are now evolving let us plead for a healthier, simpler, and more natural development. It is the great and noble task of The Royal Sanitary Institute to make the condition of the country into which these children are born, such that health, strength, and beauty, going hand in hand, will keep the English people in the foremost rank of nations as aspirants and leaders towards that perfection of mind and body which ought to be the aim that every one of us hopes to attain.

CONGRESS AT CARDIFF.

POPULAR LECTURE

By Prof. E. J. McWEENEY, M.A., M.D., D.P.H., F.R.C.P.I.,

Bacteriologist to the Local Government Board for Ireland.

(FELLOW.)

THE PREVENTION OF CONSUMPTION.

THE essential feature of a Popular Lecture as distinguished from a scientific or technical paper consists in the fact that it is addressed not to experts or specialists, but to the ordinary work-a-day citizen, with just so much knowledge as can be acquired from the daily papers or the lighter monthly magazines.

Inasmuch as knowledge acquired in this way is apt to be fragmentary or inaccurate, it would seem advisable for any one who undertakes a popular lecture on a scientific subject to begin at the very beginning and build up the edifice of knowledge from its very foundation.

My subject this evening is "The Prevention of Consumption," and I will start by telling you what consumption is. It is the commonest form of tuberculosis of the lungs and it is often called pulmonary phthisis. Tuberculosis is the name common to a great many diseases which affect every organ of the body, and differ widely from each other in the changes they bring about and the symptoms which they cause, but all of which agree in this one point: the presence of small masses or out-growths of newly formed tissue called tubercles. The word tubercle originally meant a little lump or mass of anything, but in medical language the term is now restricted to mean a local overgrowth of cells caused by the presence of a minute vegetable parasite called a bacillus. Our bodies are built up of cells just as a house is of bricks, and when the disease germs affect a lodgment within us, our cells rise up in revolt, and endeavour to surround the intruders and to enclose them as though with a cordon of sentinels. The result is the formation of a little mass called a tubercle, which is the visible outcome of the reaction of the tissues of the indivi-

dual attacked against the invading parasite. I can best compare a tubercle to the galls produced on plants as the result of the bite of a fly and the presence of its egg. You are all familiar with such galls in the shape of the so-called oak-apple and the red "spangles" that occur on rose trees.

In a tubercle the cells are not merely increased in number. Their appearance is changed, and some few of them grow so large as to look quite gigantic compared with the others. These big cells, when seen with the microscope, are a good indication of the disease which is present. Tubercles differ very much in size: some need a microscope to see them, others grow to the size of a walnut or even of an egg. To say that the average size of a tubercle is somewhere that of about the size of a pin's head is not far from the truth. Their colour is grey or yellowish.

It will occur to many of you to ask what harm are tubercles? Why does their presence constitute such a great disease? It is because they are so many poison centres, whence a destructive influence streams forth, causing the cells to die and change into a sort of yellowish cheesy matter, which is of no use for anything and may harden into a chalky mass, or, more commonly, soften down into pus or liquid matter. In this way our vital organs may become riddled with holes and fatal disease may ensue.

No organ of the body is completely immune against the outbreak of tubercles, but some parts are oftener attacked than others. According to its distribution in the body, tuberculosis assumes certain forms which I will now mention.

Firstly, there is the pulmonary form, when the lungs are attacked. This is the commonest place for the disease to occur, and pulmonary consumption therefore claims more victims than any other form of tuberculosis. The germ gets into the lung with the air that is breathed, though some now hold that it is swallowed and gets to the lungs in other ways.

Secondly, there is tuberculosis of the glands in the abdomen. This occurs mainly in babies that have been fed with cow's milk containing the bacillus. Doctors call this form *Tabes mesenterica*. It is not so common with us in Ireland as it is in Great Britain, for there is not so much factory work for our young married women and they have more time to suckle their babies.

In the third place there is tuberculosis of the glands, bones, and joints. The glands most often affected are those in the side of the neck. They swell up, forming unsightly lumps, which soften down into abscesses that discharge through the skin, and when they get well, leave disfiguring scars. The germ gains access to the glands by way of the nose, mouth

(including the sockets of decayed teeth), and very often by the tonsils. The evil is still worse when the bacillus gets into the bones, usually near the joints, as it does unfortunately very often. The way this comes about is interesting. Tiny children just learning to walk, and still in what I may call the crawling state of development, often knock their knees, their shins, or their elbows against the floor or some other hard object, and so injure the small, thin-walled blood vessels in the tender growing ends of their bones. Tubercle bacilli, which are often present in the blood in small numbers and can do no harm so long as they are shut up within the blood-vessels, are able to escape at these damaged spots and, settling down in the tissues, gradually increase and multiply; and so, after the lapse, mayhap, of years, produce a destructive focus of disease. The large joints of the limbs, the hip, knee, ankle, shoulder, and elbow, as well as the bones of the hands and feet, are commonly attacked. The back-bone is often affected, giving rise to that terrible deformity, spinal curvature. The surgical wards of our hospitals are crowded with such cases in young people of both sexes, and the amount of pain, disfigurement, and loss of working power so caused is something terrible to contemplate.

Fourthly, tuberculosis may occur in the membranes of the brain, causing the disease called by doctors *tubercular meningitis*. Children under twelve are most often attacked, and the disease in invariably fatal. The germs are carried in the blood and deposited all over the body, but the brain, being the most sensitive part, resents the attack more keenly than the other organs.

Fifthly and lastly there is *lupus*, the name given to a form of tuberculosis which occurs in the skin. The part oftenest affected is the face, and young women are the most usual victims. Lupus eats away the features, destroying the nose, lips, and eyelids, and thus produces the most hideous deformity. Hence its name, which is Latin for a wolf.

Having thus set forth the chief forms that tuberculosis may assume, I will now tell you something about the germ or bacillus which does all this harm. It is a tiny living creature shaped like a little stick, unable to move, colourless, and about one six-thousandth of an inch in length. You will get a better idea of how small it is when I tell you that about one hundred millions of these germs could lie in a single layer on the area of a penny stamp. Small as it is we can get it to grow outside the body on specially prepared jelly or on slices of potato soaked in dilute glycerine. It grows slowly, but ultimately forms crusts and scales of yellowish hue which are quite visible to the unaided eye, and are made up of incredible swarms of bacilli. The smallest trace of such a culture injected into a

susceptible animal gives it tuberculosis. The bacillus belongs to a group of lowly plants, the proper function of which in Nature is to break down dead organic matter, to cause putrefaction and decay. A few of them have acquired the bad habit of thriving in the living bodies of men and animals and so causing disease. The tubercle bacillus is one of the worst of this group of parasitic germs.

The question next arises, where does this germ come from; from what source do we obtain it? It will not grow unless at blood heat, and therefore in this country it only finds in the bodies of men and the higher animals the warmth it requires. Its only source, therefore, is the body of men and animals affected with the disease. It is found in all the discharges which reach the surface of the body from diseased internal parts. For practical purposes, however, we need only deal here with the two main sources of infection, and these are:

(1) Sputum or phlegm expectorated by consumptives, and

(2) The milk of tubercular cows.

Could we but cut off or stop up these two sources of disease germs, we should soon be able to strike tuberculosis off our bills of mortality, instead of allowing it, as we are doing at present, to kill its hundreds of thousands. In a small country like Ireland, with less than five millions of population, tuberculosis killed last year nearly twelve thousand people, most of whom died from pulmonary consumption. In Dublin last year just a thousand people died of consumption, and about three hundred more from other forms of tuberculosis. Surely this is too high a toll to pay, when, if we were earnest about the matter, we could greatly diminish our losses. And what is worse for us who live in Ireland, we keep on paying toll at this excessive rate, whilst you in Great Britain are gradually, but steadily, escaping from the grip of the destroyer. Forty years ago your death-rate from tuberculosis was somewhere about 3·2, and now it is down to 1·8. Ours is now 2·7, practically the same as it was then. The explanation may be put in a nut-shell. You have been thriving and we have not. Another unpleasant feature of the situation, as it presents itself to us in Ireland, is this: the people who are most severely stricken and contribute the largest proportionate number of deaths in Ireland, are those in the prime of life, between 25 and 35, whilst with you it is amongst children under 5, whose lives are of little economic value, that the heaviest mortality from tuberculosis occurs. That is why we, on our side of the channel, are giving so much attention to this matter. That is why, under the guidance of Lady Aberdeen, our women have organised themselves into a National Health Association, one of the principal objects

of which is to induce the people to adopt the necessary preventive measures and provide them so far as possible with the means of doing so. That is why we have been at the pains of organising two separate and distinct tuberculosis exhibitions; collections of objects illustrating the nature and prevalence of tuberculosis and how best it may be combated. One of these exhibitions has been touring the North of Ireland and the other the South. They have visited over 60 centres of population, and in connection with these visits, over 500 popular lectures, illustrated by lantern slides, have been given to audiences that have been computed to number over 400,000 people, whilst fully 800,000 have inspected the exhibitions, being about a sixth of our total population. In addition to these regular lectures, innumerable homely talks, demonstrations, and other less formal methods of instruction have been resorted to and largely availed of. For this reason also we have appealed to Parliament, and caused a Bill to be promoted which is specially directed to the prevention of consumption, and goes far beyond any measure of the sort that has hitherto been introduced. It is therefore in accordance with the fitness of things, that one of the workers in this great National campaign of ours against pain, sickness, and death, should come here and tell you what we are doing and how we are doing it.

The prevention of a disease like tuberculosis, which has no definite incubation period, no definite course, no definite period of infectivity, and the sufferers from which may keep on for years earning their livelihood whilst carrying about the deadly disease germs and spreading them around, constitutes a very difficult problem. It is a problem totally different from that which confronts us in the case of the acute infectious diseases. A case of smallpox or scarlatina can be readily traced to some previous source of infection. The patient is so ill that he cannot leave his bed; the whole thing is over one way or the other after a few weeks. The principles or springs of action (recognition, isolation, disinfection) are of course the same in the long run. But their application to tuberculosis is infinitely more difficult than is the case with any other infectious disease. It is not right, therefore, to talk lightly, as many people do, of doing away with consumption, or preventing consumption. The evil has sprung up gradually and has entwined itself in the very vitals of our population. To uproot so great a noxious growth, and one so closely interwoven in the fabric of our national life, is a work that must take many years of steady unwearying labour to accomplish. That we shall eventually accomplish it I have every confidence.

But how are we to go about it? In answering this all-important

question I would make, first of all, a little comparison which I recommend you to consider. Suppose we had to deal with the problem of a large mass of inflammable or combustible material, which was in danger of being set on fire or exploded by flying sparks, what should we do? Two things, I should say: first, prevent access of sparks, and secondly, diminish the amount of the combustible or render it non-explosive. Now, an outbreak of tuberculosis may be compared to the explosion of a powder magazine: the bacillus is the match which ignites it. The tender years, hereditary predisposition, or enfeebled constitution of the patient is the powder. The problem of preventing consumption resolves itself, therefore, into two parts: the first is to prevent the accumulation of combustible material, that is, of persons susceptible of taking the disease; the second is to cut off the supply of matches, in other words, of bacilli. The first part of the problem consists in the main of providing better conditions of life for the working class, especially for the poorer workers whose earnings are small and precarious. The chief practical step seems to me to be the provision of better housing accommodation, so as to avoid dirt, dampness, foul air, and overcrowding, especially at night. I am inclined to look upon better housing as the key of the whole situation in the case of adults; for, apart from the enfeeblement or diminution of resisting power begotten of bad housing, adults do not readily contract tuberculosis. Indeed, the resistance of many men and women is surprising, when we consider the numberless sources of infection to which they are liable. Dustmen, scavengers, and domestic servants, who have to dust out rooms where consumptives have been expectorating, are cases in point. With young persons the reverse is the case. No matter how good the condition under which they live, they can hardly escape infection if the bacillus obtains access to them. To return to our simile, children are a permanent mass of combustible matter which imperatively needs guarding against access of spark or firebrand.

In order to cut off the supply of bacilli we must stop the fountain heads from which they spring, and these, as already stated, are mainly two in number: the sputum of consumptives and the milk of tuberculous cows. The number of germs which an ordinary consumptive may cough up in the day may safely be put down at several millions.

In a coloured drawing of the sputum of such a case, when stained and prepared for the microscope, the germs, being devoid of colour, are made visible by a process of staining; the bacilli possess the property of holding on very tightly to certain stains, and the consequence is that they can be made to look red, whilst all other bacilli, and the cells of which the

sputum is mainly composed, can be made to appear of a contrast colour. Owing to this property we can readily pick out a single tubercle bacillus out of a swarm of other kinds. You may notice that many of the bacilli are lying within the cells. This is a good sign, because it shows that the cells are able to take them up and devour them. If all could thus be devoured, the patient would get well. When we send a consumptive patient to a sanatorium we hope to teach his cells how to devour the germs of tuberculosis; to give them back the power which they have temporarily lost, of acting as the policemen of the body.

The way in which the germs contained in sputum bring about infection is usually stated to be as follows:—The matter expectorated gradually dries up and mingles with the dust. When this is set afloat in the air by such operations as sweeping, beating carpets, tramping on floors, and the like, the bacilli (which are not injured by being dried up) are also suspended in the air and are breathed in. They adhere to the mucous membrane of some part of the air passages, and, like other foreign particles, such as soot, get carried through the mucous membrane, probably by wandering white blood-cells. It is beyond the scope of this lecture to discuss the details of the process, or the numerous experimental and other difficulties which almost any one of the current theories will, on close examination, be found to present. Suffice it to say that in addition to the dust inhalation theory, most of us have now come to believe in the droplet theory, according to which minute droplets of liquid phlegm are expelled from the mouth as fine spray in the act of coughing, sneezing, or loud talking. So small are these droplets that they remain for several minutes afloat in the air. They are wafted about by air currents, and are liable to be breathed in with their contained bacilli. There is experimental proof that this can really occur.

Finally, an attempt has been made and supported by carefully planned experimental evidence to show that consumption is not due to the breathing in of the germs, but to their being *swallowed*. This is a very interesting and important question, but, in view of all that still remains to be said, I must refrain from discussing it.

Whatever be the exact mode of infection, the bacilli are mainly derived from matter expectorated by consumptives, and this must therefore be collected and disinfected or destroyed. Two classes of consumptives have to be dealt with. There are the advanced cases confined to bed or to the house, and the milder cases: people who are able to get about and attend to business. It is easy to deal with the advanced cases. They should be given a suitable spittoon, and not allowed to expectorate

anywhere else. In very poor households an old mug answers the purpose. Or, rags or Japanese paper handkerchiefs can be used and burnt afterwards. The contents of spittoons can be poured on to the fire or emptied into sawdust, which can afterwards be burnt, or they can be treated with scalding water. I do not advocate chemical disinfectants for sputum, as the matter is too viscid to allow of their proper penetration. In the absence of a fire, however, we must fall back on solutions of carbolic acid (1 in 20), lysol (1 in 50), cyllin, izal, or the like. In view of the danger from droplets, consumptives should be instructed to carefully guard the mouth with a pocket-handkerchief in the act of coughing. They should on no account sleep in the same bed with anyone else, more especially with a child. A child who should sleep with a consumptive would run a fearful risk.

For the second class of consumptives, those who are able to get about, small pocket-sputum flasks, of which several patterns are on the market, are to be recommended. In sanatoria, and places where the patient's condition is known, their use should be imperatively insisted on; but in the case of persons attending to their business in public, there is this objection to the use of the pocket sputum flask: it reveals the patient's secret, and, in view of the perfectly needless scare which at present exists in many half-instructed minds, discovery might subject such a patient to the risk of losing his employment. It is not right to require a person to subject himself to this risk; and I personally see no objection to the use of an ordinary pocket handkerchief, always provided that it is properly dealt with afterwards, not allowed to get dry in the pocket, and carefully scalded or boiled before being put with the rest of the washing. There are many minor details, such as the disinfecting of table utensils, into which I have not time to enter. Expectoration in public buildings or conveyances, otherwise than into receptacles provided for the purpose, should be made a punishable offence by every sanitary authority, and the by-law should not be allowed to become a dead letter. Even warning notices are useful. I have observed a great diminution of the objectionable practice since our Irish Branch of the National Association for the Prevention of Consumption put up such notices in tramcars and railway carriages. Much might also be done for the next generation by diligently inculcating on school children the importance of refraining from unguarded and needless expectoration. I should like to see reading lessons on this subject in elementary school books.

In cleaning houses, every care should be taken not to raise a dust. Floors and carpets should be strewn with moistened sawdust or tea-leaves

before being swept. The beating of carpets should be restricted by by-law to certain times, places, and persons.

Coming now to the danger from milk, we find Koch, the discoverer of the tubercle bacillus, expressing the deliberate opinion that both the disease and the disease germs, as they occur in the cow, are different from those that occur in man, and that bovine bacilli are harmless to human beings. This opinion, expressed in the year 1901, has not been borne out by subsequent investigation, and it would now appear that the bovine bacillus has an all-round greater degree of virulence than the human one. It does not, however, seem to produce pulmonary consumption in man to any great extent, but to settle down about the alimentary canal or in the glands, bones, or joints.

A great many milch cows suffer from tuberculosis, probably at least one of every four or five. We have a very delicate way of detecting it in the tuberculin test, but it would be a great mistake to suppose that every cow that reacts to tuberculin yields bacilli in her milk. The vast majority of such cows are but slightly affected, and their only danger would appear to be that they may become more gravely so, later on. The disease, when it occurs in the udder, causes the cow to produce milk which is swarming with bacilli and highly dangerous, more especially for children; but such cases are fortunately uncommon. Still they do occur here and there, and the mixed milk from a dairy, where there is such a cow, may be highly dangerous. Now, in warding off this danger one may begin at home, or one may begin at the cow. The way to begin at home is to boil or scald all milk intended for the use of children. By scalding, I mean the process often called pasteurising; that is, heating to such a temperature, short of the boiling point, as will kill any tubercle bacilli that may be present. This can be done by heating to 190 degrees F. for a couple of minutes. Lower temperatures may be used, but they must be kept up longer. Roughly speaking, if the vessel containing the milk be placed in a saucepan of water and the water be kept boiling for a few minutes, the object is achieved. Special vessels and sterilisers can now be bought very cheaply. Young children continuously fed on heated milk occasionally fail to thrive. A teaspoonful of the juice of some fresh fruit, such as the orange or grape, if given every day, will act as an excellent corrective.

By beginning at the cow, I mean action on the part of the sanitary authority, to insure that no milk containing the germs of tuberculosis reaches the consumer. This involves taking power to compulsorily enter and inspect all dairies and cowsheds, to make careful periodical examination

of all dairy cows, and to compulsorily acquire and slaughter all animals reasonably suspected of yielding tuberculous milk. The right of inspection, etc., must extend outside the district to all places whence milk is sent in, and there must be power to take and subject to bacteriological examination samples of the milk coming in from outside places. It would be very desirable if the managing committees of large institutions, such as workhouses, hospitals, and the like, would only give contracts for the supply of milk to dairymen producing a certificate that their entire stock had passed the tuberculin test.

The institutions needed in the campaign against consumption, are three: first, the hospital; secondly, the sanatorium; thirdly, the dispensary.

Hospital accommodation is urgently needed for advanced cases in poor circumstances. Their sputum is infectious, and their continued presence in the overcrowded and ill-ventilated dwelling is a source of great danger to other members of the family, and above all to the children. The ordinary hospital will not usually admit these last-stage cases because they are very chronic and the prospect of curing them is almost hopeless. Nor would it do to have a special consumptive hospital for them. The contrast with the sanatorium, which is for early and curable cases, would be too marked. The hospital for advanced cases would soon become labelled in the popular mind with the device, "abandon hope all ye who enter here." Many incurable consumptives are unable to realise the gravity of their disease, and even were they willing their relatives in many cases would dissuade them from crossing the fatal threshold. Inasmuch as the necessity for removal only presents itself in the case of the poor, it would seem reasonable to provide special accommodation for them in the workhouse infirmary, where they should be as far as possible isolated from the other inmates. All over Ireland we are striving to obtain this accommodation in the district hospitals. We encounter the difficulty that many of the poor strongly object to become paupers, and for this reason it is advisable to relax the regulations as to admission, departure, access of friends, etc., in the case of advanced consumptives who have presented themselves, not so much on the score of poverty, as rather in order to rid their homes of a source of danger. It is wonderful to see the improvement shown by many of those advanced cases after a few weeks in a comfortable, airy ward, with generous feeding and skilful nursing.

The sanatorium is the place where the attempt is made to cure the cases that are regarded as curable. This we hope to accomplish, not by drugs or complicated remedies, but by employing the agencies that Nature has left ready to our hand, and these are three, fresh air, plenty

of nourishing food, and rest of body and mind. That these will really bring about the healing of the damaged lung I can vouch from personal experience. The wealthier and leisured classes can always procure this treatment for themselves at the many well-equipped private sanatoria which have now become so numerous in these countries and abroad. But the placing of sanatorial treatment gratuitously or at excessively cheap rates within the reach of the working-class is quite another matter. In this Germany has given us a lead. There they have an elaborate system of workmen's insurance, under which every employer and every employee has to contribute a certain fraction of the weekly wage paid by the one and received by the other. The contribution is actually made by purchasing a stamp of the required value and affixing it to a card, which must be produced on request of the Government Inspector.

The vast sums, amounting to many millions sterling, that have been so brought together are administered by Regional committees for the benefit of the contributors, to be used in any emergency, such as accidents or sickness which may deprive them of their wage-earning power. When a worker is stricken down with an illness which does not tend to get well, but threatens to deprive him permanently of his working power, he ceases to receive sick-pay and comes on to what is called invalid pay, and this he is entitled to receive week after week as long as he lives. Now, as such cases are very expensive (people with pensions are said to live long), the administrative committees of the Regional Insurance Societies make every effort to keep workers out of the grip of consumption, which is by far the commonest cause of permanent loss of working power. Accordingly they have constructed sanatoria on a magnificent scale for their working-class members. Treatment is free; families receive assistance during the absence of the breadwinner; and the latest resources of medical science, such as tuberculin injections and elaborate systems of bathing are employed. All this costs money; but the insurance committees find that it pays them better to restore a workman's wage-earning power, or to keep him from losing it, rather than to let him become a chronic invalid and a permanent burden on their funds. The results are looked at, not so much from the purely medical, as from the economic point of view. Is the patient able to work? That is what they ask; and for how long after leaving the sanatorium has he been able to keep on working and earning his full rate of wages? Five years of restored working power is regarded as an economic cure. Having personally inspected some of these institutions, I am of opinion that their splendid results are ample justification for the vast sums expended upon them. I heartily wish we had equivalent institutions in this country.

There are, however, two conditions which are absolutely essential to success in sanatorial work. The first is that the cases must be in the very earliest stage, before the patients are willing, as a rule, to admit that they are ill. The diagnosis should be made, if possible, before the bacilli have appeared in the sputum. The recognition of the malady at such an early stage is a technical matter which cannot be entered on here, but one which I consider to be feasible with care. The second condition for success is, that after three or four months' course of treatment the patient must not be allowed to go back to his old bad methods of living. A visiting committee should see to the cleaning up and disinfection of the house during his absence, and to the removal of the family, if necessary, to more suitable quarters, and finally should endeavour to procure for the convalescent patient some outdoor occupation suitable to his strength and habits.

Lastly comes the third sort of institution for the combatting of tuberculosis, the special dispensary. This is worked by a skilled doctor, assisted by a staff of nurses. A systematic effort is made to induce people who suffer from protracted colds and progressive wasting, or weakness, to present themselves at the dispensary for examination and advice. The applicant is carefully examined, his physical condition noted, and thorough inquiry made into his circumstances and mode of life. In the German type of dispensary the co-operation of the medical profession is secured by the avoidance of all interference with the patient's relations with his own doctor. No fee is taken and no treatment is given, but the patient is referred back to his own medical man or to a hospital. Applicants are visited at their own home by specially trained nurses, who assist them with advice, see that they keep their rooms clean, and their windows open, and supply them, where there is urgent need, with additional beds, food, and sometimes with money also to meet their rent, or to buy some tools or stock-in-trade with which money may be earned. A leading feature is, that all applicants are required, when presenting themselves a second time at the dispensary, to bring all the other members of the household for examination. The result is the discovery of many early cases, which are thus put on the road that leads to recovery. From this summary description, only a very imperfect idea can be gained of the immense value of a rationally conducted tuberculosis dispensary (or consultation office as I think it might better be called) in a thickly populated urban district.

Notification has been provided for in the Bill that has been introduced for the prevention of tuberculosis in Ireland. In view of the alarm and misconception which the provision seems to occasion, it would be well to make it clear that it is not intended to make other than infective forms of the disease notifiable.

As regards medical inspection of school children, you have had it definitely introduced on your side of the water this year, and I trust that we, on our side, will follow, after a judicious interval to enable us to observe your results, and to avoid any flaws that may be found in your system. In Germany, sickly children tending to decline are selected by the medical inspectors from the ordinary elementary schools, and drafted out during the summer months to special open-air schools, the feature of which is that lessons are learnt and teaching is done altogether in the open air, or in open shelters when the weather is wet. The situation is in some wooded spot in the outskirts of the town, readily accessible by public conveyance. The children arrive at seven or eight in the morning, and leave at the same hour in the evening. They are fed at the expense of the authorities, and their physical condition is carefully attended to by a competent matron or nurse, who pays special attention to their bodily cleanliness and sees that they are bathed or douched, facilities for which are provided at the school. Each lesson lasts only twenty minutes, and the progress made by the pupils is found to be equal to that obtained in double the time at ordinary indoor schools. A doctor visits every day.

The subject of the cause and prevention of consumption is a vast one, and I have only been able to touch its very fringe. Tuberculosis is Nature's weapon, with which she punishes modes of living that conflict with her rules. The best way to prevent it is to bring our mode of living, as a nation, into greater conformity with nature's precepts. I will conclude by asking you all to do one thing, which is not very difficult, and that is, to let fresh air and sunshine enter freely into your houses. Keep your windows open; don't block out heaven's sunlight with unnecessary blinds or curtains, and you will have struck a blow to save yourselves and your families from *the great White Plague*, consumption.

GENERAL AND COLONIAL NOTES.

BRISBANE, QUEENSLAND.

Alderman C. P. Buchanan, Mayor of Brisbane, presented certificates of The Royal Sanitary Institute (London) to candidates who had succeeded in passing the necessary examinations. The presentation took place in the Council Chamber, when there were present Dr. B. B. Ham (Commissioner for Public Health), Mr. C. J. Pound (Government Bacteriologist), Dr. A. C. F. Halford, Messrs. C. W. Chambers, L. G. Corrie, R. A. Fraser, and J. Kemp, members of the Board of Examiners for Queensland, and a number of gentlemen interested in municipal and health matters.

The Mayor said that it was of great importance that sanitary inspectors should be duly qualified by The Royal Sanitary Institute's certificate, and he was pleased to say that all of the inspectors in the employ of the City Council held such certificates. Dr. Ham briefly outlined the objects of The Royal Sanitary Institute, which were to collect information from various sources relative to sanitary science. They had established voluntary examinations in 1877, and had extended their sphere of action to the Colonies. He mentioned the fact that the majority of the local authorities employed as sanitary inspectors men who were not qualified, and it had been suggested that he should frame regulations to enforce the employment of men who were properly qualified by examinations under the auspices of The Royal Sanitary Institute. As a matter of fact, he had framed such regulations, but the Crown Law Officers were of the opinion that he had not the power to enforce them, and under the circumstances he could only insist that the inspectors employed by the local authorities should possess a certain degree of competency. It was most important, he said, that sanitary inspectors should be properly qualified, as the health of the area under their care depended largely on their efforts. The successful candidates were: Messrs. Thos. D. Armstrong (Charters Towers), Wm. Byres, Francis J. S. Daniel, Wm. de Lange, Wm. Jas. Henly, and Wm. Gibson Wilson (Brisbane).

NOTES ON LEGISLATION AND LAW CASES.

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FLATS. *Negligence — Dangerous Premises — Building let out in Flats — Staircase in Possession of Landlord — Staircase not lighted — Landlord, Liability of, to Persons other than Tenants — Absence of any Undertaking to light Staircase.*

The defendant was the owner of a building, the different floors of which were let by him as separate offices to different tenants, the staircase by which access to them was obtained not being let, but remaining in the legal possession

of the defendant. The agreements for the letting of the offices respectively contained no provision with regard to the lighting of the staircase. The tenants respectively had gas lights on the landings outside the entrances to their respective offices, which were supplied with gas from their own meters, and the practice was that each tenant on leaving his office for the night turned off his own light, but it did not appear that there was any agreement between the defendant and the tenants that they should light the staircase. The plaintiff, who was in the employ of one of the tenants, upon coming down the staircase from his employer's offices on an evening in March at 8.15, when all the lights having been put out, the staircase was in darkness, failed to find his way out through the street door into the street, and, going further down the stairs towards the basement, fell through a door opening upon a flagged courtyard at some distance above the level of the flagstones. This door was used for hoisting goods into and out of the building. In an action brought by the plaintiff against the defendant in respect of injuries resulting from the fall:

Held, that there was no duty towards the plaintiff imposed upon the defendant to light the staircase, and consequently the action was not maintainable.

Miller v. Hancock, (1893) 2 Q.B. 177, discussed and distinguished.

Hugget v. Miers. C.A. 278. H. K.B. June, 1908.

REMOVAL OF REFUSE. *-London - Hotel—Trade Refuse—Dispute between Occupier and Sanitary Authority Decision of Petty Sessional Court "shall be final"—Appeal by Special Case Summary Jurisdiction Act, 1879 (42 & 43 Vict., c. 49), s. 33, Public Health (London) Act, 1891 (54 & 55 Vict., c. 76), s. 33, sub-s. 2 - Metropolis Management Acts.*

In any dispute between the occupier of premises and the sanitary authority as to what is to be considered trade refuse, the decision of the magistrate under s. 33, sub-s. 2, of the Public Health (London) Act, 1891, is final, and no appeal will lie to the High Court, notwithstanding the Summary Jurisdiction Act, 1879, s. 33, which provides for the stating of a case upon a point of law upon the application of any person aggrieved by a decision of a magistrate.

Decision of the Court of Appeal, (1907) 1 K.B. 910, affirmed.

Westminster Corporation v. Gordon Hotels, Ltd. H.L. (E.) 2 A.C. June, 1908. 142.

WATER. *Waterworks Reservoir Lands purchased by Agreement for the Purposes of Waterworks Mines and Minerals purchased together with Lands Right to support from Minerals under adjacent land Limit of forty yards Waterworks Clauses Acts, 1847 (10 & 11 Vict., c. 17), ss. 18-27.*

Under a special Act, which gave the respondents power to purchase land by agreement, but not compulsorily, and incorporated the Waterworks Clauses Act, 1847, the respondents bought land from T., including all mines and minerals

underneath, and also bought adjacent land from S., who reserved the right to work the coal underneath without making any compensation. The respondents constructed waterworks upon both pieces of land. The appellants, who were lessees of the coal from S., gave the respondents notice under s. 32 of the Waterworks Clauses Act, 1847, of their intention to work the coal under the land bought from S. The respondents gave no counter-notice:—

Held, that the land bought from T., having been bought by agreement, enjoyed the common law right it had always possessed to lateral support from the land bought from S., this right not being affected by the Waterworks Clauses Act, 1847; and that the appellants were entitled to an injunction restraining the lessees from working the coal either within or beyond the forty yards belt round the waterworks so as to damage the land bought from T.

Decision of the Court of Appeal, *Manchester Corporation v. New Moss Colliery, Ltd.*, (1906) 2 Ch. 564, affirmed.

New Moss Colliery, Ltd. v. Manchester Corporation. H.L. (E.) June, 1908. 117.

WATER. *Neglect to furnish a Supply of Water for Domestic Purposes—Insufficiency of Supply—Penalty—Waterworks Clauses Act, 1847 (10 & 11 Vict. c. 17), s. 43.*

By s. 43 of the Waterworks Clauses Act, 1847, if a water company "neglect or refuse to furnish to any owner or occupier entitled under this or the special Act to receive a supply of water (sic) during any part of the time for which the rates for such supply have been paid or tendered," they are to be liable to a penalty:—

Held, that the above provision applies only to a total cessation of the supply, and not to a neglect to furnish a sufficient quantity. If the water company continuously supply the consumer with some water for his domestic purposes, the fact that the quantity supplied is insufficient for the reasonable requirements of his house does not constitute an offence within the section.

Stimpson v. South Oxfordshire Water and Gas Company. Div. Ct. 1 K.B., May, 1908. 917.

WATER.—*Reservoir—Land compulsorily taken—Compensation—Special value Obtainable by Compulsory powers—Reservoir.*

Where land is compulsorily taken for the purpose of making a reservoir and the land has a natural and peculiar adaptability for the construction of a reservoir, the tribunal assessing the compensation is not precluded from taking into consideration the natural adaptability of the land by reason of the fact that the land could not be utilized for the construction of a reservoir unless parliamentary powers for the compulsory purchase of other land were first obtained.

In re Lucas and Chesterfield Gas and Water Board. Bray, J., 571, 1 K.B., March, 1908.

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CONGRESS AT CARDIFF.

SECTION I.—
SANITARY SCIENCE AND PREVENTIVE MEDICINE.

ADDRESS

By DAVID S. DAVIES, M.D., D.P.H.
Medical Officer of Health, Bristol.
(FELLOW.)
PRESIDENT OF THE SECTION.

A THOUGHTFUL writer and critic, not a member of the public health service, uttered the following pregnant suggestion at a recent discussion on the present position and outlook of preventive medicine:—

> "I venture to suggest that the time has come for the establishment in each local government district of convenient area and population, of one principal medical officer of health, . . . giving up his whole time to his duties; having under him not only the local registrars and the sanitary inspectors and vaccination officers, but also a qualified staff of health visitors, some of whom should be nurses, and others qualified medical practitioners; finally responsible for the administration of all the local hospitals and infirmaries for different diseases and classes of patients, all having their own several staffs: and controlling also, working in conjunction with these indoor staffs, an adequate staff of visiting practitioners, who should visit all such persons as desire their professional aid and who are reported as physically needing it. All this comes to little more than what is actually being done to-day in those cities which enjoy both an active public health department and an energetic poor law medical service. What seems wanted is concentration of responsibility and direction in the medical officer of health, provided with a competent and duly differentiated staff of salaried assistants. Only by such provision can we hope to enforce in all districts the extensive prevention of and varied provision for ill-health and disease."

This suggestion embraces two main ideas: first, co-ordination between the public health and poor law medical services (a wide theme, which it is

not my present purpose to discuss); and, secondly, concentration of responsibility and direction in one chief administrative public health officer, with the corollary that he shall be duly provided with *a competent permanent staff*, sufficient to insure the possibility of a thorough execution of his multifarious duties.

In so far as this relates to the question of preventive medicine as distinguished from medical treatment, it forms an ideal towards the realisation of which it seems imperative at the present time that we should devote some earnest consideration.

The remarks I have quoted recognise the distinguished position as an administrator which, in the opinion of some critics, should be attached to the medical officer of health as a representative of state medical matters. But signs are not wanting in certain quarters that, in the opinion of other critics, the medical officer of health may, when special medical duties of state importance need to be undertaken, take a back seat; that his interference is unnecessary and, in a degree, impertinent; and that, as some of these critics hardly hesitate to remind him, he had much better continue to confine himself to the suppression of nuisances, which they conceive to be his peculiar function, and leave questions of medical import to another and a newer school of medical specialism. But while the medical officer of health may reflect that, after all, the younger branches of medical specialism do well to place their knowledge on a pedestal; it at the same time behoves him "furiously to think" whether, after all, there has been given occasion, not only for some specialists, but for most laymen to regard the medical officer of health, not as a medical administrator and an epidemiologist, but as a superior (if less practical) nuisance inspector.

The reasons for the opinion that has undoubtedly grown up that the whole functions of public health administration are concerned with no more than the securing of general cleanliness are not far to seek.

The beginnings of Victorian public health legislation were intimately bound up with the lessons begotten of cholera prevalence, and the outstanding facts disclosed by the investigations of the Health of Towns Commissioners, were, in the main, facts of appalling filth, neglect, and dirt. The crusade which followed was wholly advantageous: and in turn purity of water, purity of soil, municipal cleanliness, purity of air, regulation of conditions of work at home or in the workshop, regulation of the production and distribution of food, and correlated matters of general importance towards wholesome conditions of life, have come under review and have, to a large extent, been met by appropriate legislation.

The earlier Public Health Acts were frankly concerned in chief with

the suppression of nuisances; and the constitution of sanitary areas, each with its local medical officer of health, provides for the immediate supervision of such matters and the execution of routine regulations in each area more or less independently. The provisions in relation to disease were based on the general assumption that the communicable diseases were identical in nature and habits; and prominence is in general given to the idea of place infection, or the spread of disease by local injurious influences, as much as by direct personal infection, the immense importance of which in the continuance of infection is daily becoming more apparent.

The determination of the causal organisms of certain of the bacterial diseases appeared likely to simplify the question of prevention, but much had to be learnt by painful experience and disappointment as to the varying parasitic habits of different species, owing to which no broad generalisations held true. It was soon recognised that the diseases which, for example, were chiefly intestinal, adopted methods of securing their continuance as a parasitic species differing from those which were distinctively exanthematous; but, in spite of experience, the idea that all communicable diseases have some occult relationship to drain defects appears for the moment to be ineradicable, not only from the lay mind but from large numbers of the medical profession.

When the bacterial causal organisms were first demonstrated, it was assumed, in the case of what were grouped as the "acute infectious diseases," that the parasitic organism invaded the body, occupied it during the course of the disease, and finally, upon recovery, disappeared, leaving no stragglers. Now we know that in a certain proportion of cases this is not so. The patient may recover, but may continue for a longer or shorter time, perhaps for the rest of life, to harbour the organism, and so become a potential source of danger to the community. Such cases (carriers) interfere signally with the easy control of infection, and set at naught the crude precautions directed against local conditions, fomites, and place infection.

The extremely mild case (minimal) presenting no definite clinical symptoms, or at most negligible symptoms, is another fruitful source of failure in the control of infection; for these are the cases which, though capable of transmitting disease, escape the control of isolation, and adopt no precautions against spread. In the case of the parasitic infective disease, then, the sum of the reaction between the parasite and the human body has to be reckoned with, not the simple fact of the invading parasite.

Still more recent work in regard to the group of diseases that require

alternative hosts for the completion of their life-history, of which malaria and yellow fever may be taken as typical examples, has shown the complexity of the problems that have to be attacked by the student of preventive medicine.

Epidemiological problems, too, have now to be solved not by methods of observation only, but by observation controlled by experiment, and the services of the pathologist as well as of the naturalist must be sought in aid. But it is essential that the medical officer of health must advance with the times, and must, though no one man can be expert in every branch of natural science, keep himself so instructed that he may well know, as an administrator, how and when he may best avail himself of the knowledge of others.

Important as are the services which he may render to the state in carrying out the routine duties which fall to his share, his medical instincts must make the elucidation of epidemiological problems and the administration of medical work the chief interest of his life work: and he should take care that he does not, through lack of seizing opportunity, allow the elucidation of these vital problems to be wrested from his hands.

The argument has been forcibly stated by a distinguished American health officer in these words:—

> "When I was elected health officer in 1884, municipal sanitation was synonymous with municipal cleanliness, more than half the money and effort expended by health departments was for cleansing the city and the abatement of nuisances, the text books told us that to secure pure soil, pure water, and pure air was the whole of hygiene. But the *filth* theory is dead, and we know dirt is very rarely the *direct* cause of sickness. . . . The health officer is certainly heartily in favour of clean streets, ample sewers, good plumbing, public baths, well-kept yards, and clean tenements. All these certainly, though chiefly in an indirect way, make for better health. But most of them can be secured as well, or better, through other agencies, and the health officer should be free to devote more energy to those things which he alone can do. He should not waste his time arguing with the owners of pigsties, or compelling landlords to empty their cesspools. The police can do that. The health officer had better be showing a working girl how to escape infection from a tuberculous brother, or explaining to a physician the danger from typhoid carriers. The health officer should not be directly concerned with the removal of garbage, or the purification of sewage, or street cleaning. These are the functions of the department of public works. The inspector of plumbing is very properly not an official of the health department. The same is true of the smoke inspector. The most important field for sanitary effort at the present time is the direct control of the infectious diseases, . . . the medical inspector is the most important officer in the health department. There is one who gives all his time to the work, and another who gives part of his time, looking after tuberculosis alone."

He then expresses the need for a whole-time physician to look after tuberculosis; and for another to look after diphtheria, to inject antitoxin and to take cultures; and incidentally points out how, in the health department, they have decreased the nuisance inspecting staff, which he considers to be a function of the police department. The tendency is to build up the health department as a purely medical department, with appropriate medical assistance, and to relegate the important non-medical duties of municipal cleansing and general control to the department of public works.

So much for an American opinion. But the question which concerns us in England is whether we are obtaining due facilities for securing the best medical service in preventive medicine under the present system, and, if not, how this might best be secured.

Primarily, the English medical preventive service has also been built up round the question of nuisances, and the medical aspects of the case occur as afterthoughts. Now we know that the medical service ought to be constituted so as efficiently to secure medical work, with access to immediate use of the pathological and chemical laboratory, not as mere adjuncts, but as an integral part of the service.

In many of the larger centres, some approach to this ideal is attained; medical inspectors act as practical assistants to the administrative medical officer of health, pathological and chemical research is provided for. But in many of the smaller districts the medical officer of health is in a condition of splendid isolation. So long as he confines himself to the routine work which involves no extra expenditure, all is well: but isolation hospitals, laboratory assistance, and any suggestion of expenditure on medical assistance or on research work would procure him more than a bad quarter of an hour. Thus, much that is essential has to be passed over, or can only be secured with friction under the pressure of an epidemic.

With the advance of more accurate knowledge as to the methods by which disease is spread, in view of the growing importance of the personal transmission of disease and the frequent necessity for experimental determination of the presence of infection, it is to be hoped that some means may be found by which all districts may be placed in the possession of facilities for securing effective control of disease.

It is obvious that each of the smaller districts cannot hope to be equipped with independent pathological and chemical laboratories; but there is no reason why every district should not share in the full advantages of medical research such as are available in the larger centres of population. Nor can the medical officer of health of a small district

always spare the time from his private practice to work out the details of a complicated outbreak, but there is no reason why he should not always have expert assistance ready to hand.*

The disadvantages under which small districts labour are (1) isolation and (2) the fact that invasion of disease being only occasional, it is looked upon as exceptional and dealt with from the point of view of suppression rather than of prevention, while the intervals of freedom are rarely used to good effect. The isolation of the smaller districts also militates against the adoption of a continuous policy of intelligent progress, the need for which would become apparent and its execution possible if the districts were viewed collectively as integral parts of a larger administrative area.

Co-ordination is needed, not to swallow up the smaller districts in a greater area, but to harmonise the work in each district, to supply on occasion laboratory assistance or special epidemiological investigation, and to secure a continuous and progressive policy over each area.

A good deal of work of the kind suggested is secured already in counties where a county medical officer of health is appointed, and the recent stimulus of school inspection has promoted the appointment of others. But the county medical officer of health is not as yet in all cases provided with a "competent and duly differentiated staff of salaried assistants," essential for his full usefulness, so that any epidemiological work or any special research work, pathological or chemical, may be set going at once without delay or question. Some authorities are sufficiently ready to add to the responsibilities of a county medical officer of health without recognising the value or the brain-cost of supervisory work, and without providing the necessary assistance for the work which has to be done and to be supervised. The position of the county medical officer needs in many cases to be placed upon a clearer basis, and the facilities at his disposal for effective assistance, supervision, and control over the public health medical work of the district need to be made more complete.

But before we can hope for complete organisation of every large area, the lay mind must first become convinced of the growing importance of strictly medical work in preventive medicine, and must once for all dismiss the idea that medical research is an expensive fad, and that the whole science of public health is comprised in the idea of "municipal cleanliness."

* In Prussia the difficulty has been got over by the establishment of "Typhoid Examination Schools" and "Bacteriological laboratories" at convenient centres, available for all medical men, the cost defrayed by a State grant. (Dr. Martin Kirchner, Berlin klin Woch.)

MEDICAL INSPECTION OF SCHOOLS.

By H. MEREDITH RICHARDS, M.D.,
Medical Officer of Health, Croydon.
(FELLOW).

AT previous Congresses of The Royal Sanitary Institute one would have been expected to preface this discussion with a recitation of some of the reasons why it had become incumbent on the state and on local educational authorities to undertake the medical supervision of children attending elementary schools. Happily this is no longer necessary. Medical inspection of schools is now *in being*, and the statutory obligation imposed by section 13 of the Education (Administrative Provisions) Act, 1907, has met with such general acceptance that its wisdom no longer needs discussion.

It is also unnecessary at this stage to discuss the relation of the medical officer of health to medical inspection, as that has already been settled for most of us. What we have to consider is how we can best carry out the actual work in the schools.

To introduce a discussion on the methods and aims of such medical inspection is, however, by no means a light task. Even a cursory survey of all the numerous problems which suggest themselves is obviously impossible, and one can only attempt to deal somewhat superficially with a few of the more important points.

Much is being said about the desirability of securing uniformity of methods and uniformity of detail throughout the country. I am sure that you will agree with me that this is for the most part to be deprecated. Not only do local circumstances differ, but in this early stage in the evolution of school hygiene uniform methods would materially check progress. Rather let us hope that, as in other public work, different authorities will proceed along somewhat varying lines, and that as experience accumulates we shall recognise our own mistakes and profit by the greater wisdom of our colleagues.

Education Authorities and Medical Inspection.

The statutory obligation imposed by the Act of 1907 has recently been defined by the new code, which, by Article 25 (c) requires that "satisfactory provision must be made for the medical inspection of

children attending the school . . ." and by Article 58 provides that managers shall give the Local Education Authority all reasonable facilities for the purpose of medical inspection, and specifically directs that all children admitted after August 1, 1908, and all children expected to leave school before 31st July, 1909, must be medically inspected during the coming educational year. Provision is also made against loss of grant through interruption of ordinary work caused by medical inspection. It is obvious, therefore, that the Board of Education is now in a position to deal effectively with any authority which neglects to make satisfactory provision for medical inspection or does not carry it out to the extent indicated. It is to be hoped that there will be little necessity for the exercise of this power. It would, however, be more satisfactory if a definite part of any additional grant, say not less than one shilling per child, were allocated to the cost of medical inspection. Medical officers would certainly be in a far stronger position if they could show that a definite grant was dependent on the effective work of the medical department. In the new code we also find regulations relating to the exclusion of children from school on medical grounds by the School Medical Officer. I am sure you will all agree with me in the hope that the next code will provide for the payment of the ordinary grant in respect to these children. As these children can only be excluded on the certificate of the Medical Officer, the amount of this grant could be calculated without those clerical complications which sometimes impaired the value of the old epidemic grant under Section 101* of former codes.

Co-ordination of Medical Inspection with other Public Health Work.

As the memorandum of the Board of Education pointed out, both economy and efficiency will best be served by making the fullest use of existing machinery. Thus the clerical staff of the public health department, supplemented when necessary, will be available for tabulating returns, issuing notices and so forth while the office itself can often be utilised as a convenient centre for special examinations of the children. Similarly in those districts where the sanitary and education authorities are identical the inspector for infectious diseases can keep the records of school contracts and assist in carrying into effect any directions that may be given concerning quarantine of school children. The same officer can usefully be employed for the inspection of the sanitary annexes of their fittings. Where health visitors are available they can (*a*) act as school nurses and assist at the medical inspections, (*b*) make preliminary enquiries concerning illness among absentees, (*c*) act as a medium between the medical officer and the parents, especially by keeping children under

observation until the advice given has been followed, (*d*) give detailed advice in the homes on domestic hygiene, dietetics and so forth.

The borough laboratory will be invaluable when doubtful cases of diphtheria, tuberculosis, ringworm and so forth are concerned.

Where the local authority has its own mental hospital the medical superintendent should act as consultant in special cases.

It is needless to say that the work of the medical inspector necessarily brings him into touch with the attendance officers, and I can cordially recommend the institution of a weekly conference at which the medical officer, superintendent attendance officer, health visitors and infectious diseases inspector may discuss outstanding cases and prevent misconceptions.

Assistance of the Teachers in Medical Inspection.

Obviously the extent of this assistance cannot be clearly defined at the present moment. Some little time must elapse before intelligent solicitude for the physical well-being of school children takes its proper place in the daily work of the teacher.

To the teachers we must look for the selection of children for special examinations, *i.e.*, at examinations other than the three or four periodic inspections required by the Board of Education. Teachers, too, will in most instances be the first to notice the early symptoms of communicable disease.

At the medical inspection itself teachers will naturally assist in the organization; be present at the actual examination of the children; help in securing treatment by distributing hospital letters, and especially by the judicious use of that tactful influence over parents which has already done so much for the young people in our schools.

In the future we shall doubtless see many teachers voluntarily undertaking anthropometric work, observations on fatigue, on ventilation, on the temperature of classrooms, as a few pioneers have already done.

The Co-operation of the Parent.

If medical inspection is tactfully introduced into a school there is no fear that it will not be welcomed by the parents. It need hardly be said that if a parent objects to his child's throat or eyes being examined, then that parent's prejudice should be respected unless there is some weighty reason to the contrary such as the presence of an epidemic of diphtheria or *prima facie* evidence that the child comes within the meaning of the Education (Defective and Epileptic Children) Act, 1899. Similarly, if a nervous child objects to a tongue depressor then the examination of the throat must in most cases be postponed.

Much misconception will be removed if one of the parents is present at the examination, and in spite of the all too-frequent loquacity of the mothers of defective children, I am convinced that a balance of advantage and true economy of time result from their presence at the inspection, for the following among other reasons. The details of any past illness can be more readily obtained: advice is more telling when given direct to the parent than when it has to filter through the post or is carried by an intermediary; warnings as to uncleanliness are more effective and less offensive when the actual condition of the child can be appealed to. Failing the presence of the mothers we must rely on the pressure that can be exerted by the teacher and the health visitor or school nurse. Whether the verbal advice is given by the doctor or by the health visitor, it is well to provide a set of cards or leaflets in which advice concerning the common defects found in school children are set forth in simple language. I refer in particular to such matters as the care of the teeth, hygiene of dress, the care of rheumatic children, the importance of fresh air, hours of sleep, etc.

Provision should also be made for securing hospital letters when required, and for enlisting the co-operation of local charitable organisations when material aid is required.

Time Required for Medical Inspection.

On the average an experienced medical inspector will dispose of about twenty children in a school session, provided that he has the assistance of a school nurse, and can refer children requiring detailed examination to some properly equipped centre. As the work proceeds I am hopeful that teachers and school nurses will become so adept in sorting the children into groups, and give so much help in other ways, that the routine inspection will take even less time than has been indicated, and the energy of the medical inspector will be increasingly devoted to the complete examination of selected children and to research work.

On the other hand, there will be advantage in expending somewhat more time over each examination during the first year, as the medical inspectors will thus get a better grasp of the various problems of school work, and gradually gain that sense of perspective and relative proportion which are so essential when "practical schemes for attending to the health and physical condition of the children" have to be submitted to local authorities and to the Board of Education.

Standing Orders Relating to Health.

In many districts these will need revision and amplification. Those relating to communicable disease will usually need considerable modifica-

tions in consequence of the more precise methods which are now applicable. In framing these standing orders three general principles should be borne in mind. Firstly, Koch's dictum that preventive methods should vary with the natural history of the disease. Thus older methods of dealing with measles contacts in schools for elder children may safely be modified in the light of Thomas's work on measles in London schools.

Secondly, we have to remember Chapin's dictum that disease is spread by infectious persons rather than by infected things. Of this we have a striking instance in class epidemics of diphtheria which, as Dr. Davis has so clearly shown, can usually be referred to a missed case of nasal diphtheria, and are controlled by discovery and exclusion of the culprit rather than by burnt offerings of sulphur or libations of germicides.

Lastly, we must so frame and apply our standing orders as to produce the minimum of interference with school and home that is compatible with efficiency. Unless this is done we shall never secure that willing co-operation that is essential to success.

In addition to general instructions concerning the health of the children the standing orders should also contain directions as to the routine to be adopted at medical inspections and be annotated so that the staff may understand the reasons for the various rules laid down. It is also convenient to interleave the standing orders so that supplementary annotations and directions to teachers may be conveniently added when occasion arises.

When considerable changes in routine are involved it is helpful to summon a conference of head teachers so that the standing orders may be explained and misunderstandings obviated.

The Objects of Medical Inspection

can be summarised under four heads.

1. The classification of children for educational purposes. This is fully dealt with in Dr. Thomas's paper, to be read in the Conference on the Hygiene of School Life.

2. The introduction into the schools of a high standard of personal cleanliness. All who have practical experience of elementary schools will appreciate the extreme importance of this object. As there is general agreement concerning the measures to be adopted, they need not be discussed in detail. For this purpose the co-operation of school nurses and attendance officers is indispensable.

3. The diffusion of hygienic teaching. This will naturally result from the reiterated advice given to the parents, children, and teachers at the inspections, as well as from the hygienic atmosphere which will ultimately be produced in the school.

4. The prevention and cure of disease. It is this last object that presents most serious difficulty.

For the moment we shall doubtless have to content ourselves with general hygienic advice coupled with "advice to take advice," or the offer of a hospital letter where definite medical or surgical interference is imperative. It is obvious that one or other of two results will ensue. Either our advice will be disregarded and nothing will be done or the local hospital will become more overcrowded than it is at present. Neither possibility can be viewed with equanimity by any intelligent authority armed with powers "for attending to the health and physical condition of the children." Obviously medical inspection will be a failure if preventible diseases are still unprevented, and it would be unfair for local authorities to cast further burdens on the long-suffering voluntary staffs of our great hospitals. I would suggest that a *via media* between a policy of *laissez faire* and the socialisation of medicine is to be sought in the establishment of school clinics for those children who require treatment which no existing agency is really in a position to supply. It is impossible to enter into full details, but a few examples will make my meaning clear.

1. The treatment of eye diseases, including refraction work, must be undertaken by the local authority if satisfactory progress is to be made.

2. Similarly the local authority must make satisfactory arrangements for the treatment of the more chronic skin diseases and for those diseases of the nose, ear, and throat in which operative interference or special methods of examination are impracticable under the ordinary conditions of club or dispensary practice.

3. Arrangements must be made for the medical supervision of delicate children and of suspects who are rightly kept from school because they are a possible danger to others, but are not sufficiently ill to ensure their being attended by the family doctor or by the district medical officer.

When I add to these duties that of co-ordinating school work with that of local charities, so that convalescent letters may be available where they are really wanted, I think you will agree that many more conferences will be held before medical inspection becomes completely organised.

Lastly, as this congress is held in the chief town in Wales, I would like to express the hope that Wales, which has made so many sacrifices for the moral and intellectual progress of her children, will be equally strenuous in securing their physical welfare.

[*For Discussion on this Paper, see page 350.*]

MEDICAL INSPECTION OF SCHOOL CHILDREN.

By PHILIP BOOBBYER, M.D., M.S., M.R.C.S.,

Medical Officer of Health, Nottingham.

(FELLOW.)

IN taking part in the discussion on the medical inspection of school children, my object is to call attention to certain matters which have exercised my own mind considerably while I have been engaged in drafting a scheme of inspection for the City of Nottingham under the new Act and Memoranda.

Of the details of practical inspection under the new *régime* I am not specially qualified to speak, as my actual experience of such is extremely limited; and much of what knowledge of the subject I possess has been gathered from the writings of others who have made a careful study of it.

Up to the present year the work of inspection with us, as for the most part with others, has consisted principally in the sanitary supervision of school premises, and in dealing with cases of infectious or communicable disease among school children and those with whom such children live. This work has been carried out principally by myself and two lady health visitors, with occasional help from my assistant at the Isolation Hospital, and other medical men. It has hitherto been done on behalf of, and at the expense of, the Health Committee, although sanctioned and approved by the Education Committee. Under the new régime this section of our duties falls under the supervision of the Education Committee, and I foresee already that it will not always be easy in the future to act in accordance with the policy and practice of the past, and at the same time to satisfy the wishes of the new authority. The medical officer of health and his coadjutors will often have to look at matters quite as much from the educational as from the health point of view, if they are to avoid friction.

The playing of one committee against the other involves an altogether impossible policy.

In conceiving points of difference I am not thinking of such old fashioned practices as general school closure for, say, measles or whooping-cough. Most authorities, both Health and Educational, are now agreed that such practices should give place to judicious exclusion of susceptibles, or class closure at the most, except in the case of schools serving very scattered populations. I am considering, rather, such matters as, say, (*a*) the policy to be adopted with respect to infant schools, crèches, or play centres, and (*b*) the line of action to be taken for dealing curatively and preventively with cases of such affections as ringworm, scabies, pediculosis, and impetigo.

I cite these two examples, because they serve to exemplify matters respecting which extremely divergent opinions are likely to be held, according to the point of view from which they are regarded.

With respect to the first, the far sighted and philosophical social reformer will condemn them generally as tending to diminish the sense of parental responsibility on the part of the mother, and of both paternal and marital responsibility on the part of the father. Such a critic will say that the mother's place is at home with her infant children, and that the father should do all in his power to make such provision as will enable the mother to live comfortably at home with her offspring, unoccupied save for her maternal and housewifely duties.

The simple educationist on the other hand will insist upon the desirability of bringing the children as early as possible under disciplinary control, especially in cases where the home influence is likely to be bad.

Now, one of the special aims of a sanitary authority in a large urban centre at the present day, should be, and mostly is, to improve the homes of the poor both from within and from without, and one of the most effectual ways of improving the home from within is to strengthen home ties and foster the idea of home, with the mother and children as central figures in intimate association. The policy of making indiscriminate provision of infant schools, crèches, and play centres is directly opposed to this principle.

Again, with regard to my second illustration, the presence of pediculous, and other like conditions, is generally indicative of a want of, and a proper respect for, personal cleanliness.

The health expert considers such conditions intolerably filthy and degrading, and would favour the adoption of a policy of exclusion and compulsory treatment for all subjects of them. The pure educationist, on

the other hand, is disposed to argue that as such conditions involve practically no danger to life, and do not incapacitate from work, they should not be allowed to interfere with the instruction of those affected by them.

So much for the necessity of acting very circumspectly and tactfully in dealing with such matters as those I have mentioned, and of looking, as far as possible, from the two points of view, respectively, of the two authorities we are now called upon to serve, at all questions of school hygiene in the future, when formulating any definite policy concerning them. The failure on the part of some medical officers of health to do this in the past, has perhaps given rise to the statement we have most of us heard, that by our training and predilections we have become unfitted to undertake the delicate dual function which as joint medical officers of health and of schools we shall have to perform.

I shall now very briefly discuss certain details of administration which I dealt with in a report on the inspection of school children, prepared in February last for the joint Health and Education Committee of the Nottingham Corporation.

After studying the memorandum issued by the Board of Education in November last, I was struck with the very large amount of personal inspection and examination of children which would have to be made (and made on the school premises) under this memorandum. It appeared to me that several very useful purposes could be served, at once, by dividing the City into school inspecting districts of, say, twenty schools each, and establishing, at a convenient point in each, a school clinic or examination house where all children requiring special examination for mental or physical defects or disorders (other than pediculosis) could be examined, and also, to some extent, treated. The verminous subjects would, as heretofore, be sent direct from the schools to the disinfecting stations of the City for treatment, these stations having been specially fitted for the purpose with baths and other conveniences, in addition to their ordinary equipment.

I recommended that each of these examination houses or school clinics should be the residence of the lady health visitor, or school nurse, of the district to which the clinic belonged. It seemed to me that this scheme would have the following distinct advantages, over one which involved the exclusive use of the school premises for the inspection and examination of the children:—

(1). It would be more economical, inasmuch as it would obviate the necessity of completely equipping all the schools, or at least a large number of them, for examination purposes.

(2). It would entail much less interference with purely educational work.

(3). It would promote efficiency in the work of examination and inspection, and would be more convenient for all parties concerned.

(4). It would provide a special central-bureau for the gathering of information and the transaction of all business connected with the work of examination and inspection in certain definite areas and groups of schools.

(5). It would provide a fitting local habitation for the school nurse or nurses, or lady health visitors, of each district, who would thus be brought into closer touch with the schools, the school children, and the homes over which they were required to exercise supervision.

This scheme, thus briefly sketched, has not yet been definitely adopted, though unanimously approved by the joint Health and Education sub-Committee of the Nottingham Corporation to which it was submitted. The Committee agree with me in thinking it would make at once for economy, convenience, and efficiency in the work of inspection, and on these grounds also on the present occasion I venture to offer it for your consideration.

[*For Discussion on this Paper, see page 350.*]

AMELIORATION OF THE DEFECTS IN SCHOOL CHILDREN DISCOVERED BY MEDICAL INSPECTION.

By EDMUND M. SMITH, M.D., D.P.H.,
Medical Officer of Health, City of York.
(MEMBER.)

ABSTRACT.

THIS is a matter of great importance if the Act is to be worth anything, but it is also a matter which presents great difficulties, especially with regard to the proper treatment of defects of vision, defects of teeth, ringworm and adenoids. It is very desirable, if possible, not to trespass on the sphere of the medical practitioner, not only for his pocket's sake, but because his appreciative co-operation in the work under this Act is essential, and because it is eminently desirable that we should increase parental responsibility for treatment of such defects.

With regard to the majority of the ailments and defects of children I think we should be able to persuade or insist upon the parents obtaining proper medical treatment, but with regard to the three or four other special defects which I have mentioned there is some difficulty.

First, there are few medical practitioners who lay themselves out for examining defects of vision and prescribing spectacles or other necessary measures. Such work is tedious and exacting, consequently the fee that it demands is a prohibitive one, or at least a heavy one, to a large proportion of working-class people.

Secondly, dentists' fees for stopping decayed teeth and other such special work are also prohibitive.

Thirdly, a very large proportion of parents will not pay their medical attendant's fees for the treatment of ringworm, consequently they go to druggists, who prescribe a routine ointment and see nothing more of the case; probably nine times out of ten such cases become chronic, they are either absent for a very long time from school or spread the contagion wholesale in school, and perfect cure is a very doubtful matter in such cases.

What is to be done to meet these difficulties?

I think we should first of all approach the medical practitioners and the qualified dentists as to how far they are prepared to meet the large additional amount of eye work and dental work resulting from the medical inspection of the school children in respect of fees.

Then we should approach our local hospitals and dispensaries as to their dealing with the cases which cannot afford to pay any fee at all, and as to dealing with such minor operations as those for adenoids, which, irrespective of fees, are much more conveniently performed at such institutions. Failing the doctors and the hospitals, I see nothing for it but the establishment of the school clinic.

For the treatment of ringworm, pediculosis, and impetigo, I think we shall in any case require a central school clinic, and, of course, there will also be the advisory work of the school-nurse in the home.

[*This Discussion applies also to the Papers by* Dr. H. Meredith Richards, *page 339, and* Dr. Philip Boobbyer, *page 345.*]

Dr. H. Manley (West Bromwich) said that as a practical man he wished to emphasise some points. As far as he could see, no medical examiner could do the work rightly, and retain his private practice and his self-respect.

One of the key-notes of the success of the examination was the presence of the parent at it. Direct verbal advice given to the parent was worth all the postcards and handbills that had ever been issued. There were some authorities who still believed in sanitation by handbill: they went to light the working man's pipe or into the waste paper basket where there was one. By all means send the health visitor to emphasise the advice, and the parent would thus be told the advice twice over. Besides, when it was necessary to censure a parent, and such cases were not unfrequent, the effect was so much greater when you had both child and parent before you and could point out the condition to be remedied past all power of denial.

The position of the teachers was of great importance: medical examiners should remember that the clerical work of the teachers had much increased of late years, and should be very careful not to overload them in the matter of examination. The excellence of the school teacher, especially among the infants, was shown by the influence she possessed not only over the children but over the parents. This could be seen by the number of parents whom she could induce first to attend the examination and next to carry out the directions of the medical man. There were schools in which he had seen 100 per cent. of the parents of children examined, and there were others where he had seen fewer.

He felt that it was part of his duty to let his authority know what sort of support he had got from the teachers, good and bad.

Then there was the question of treatment and the relation of the examiner to the profession. He regretted to say that in his experience the carrying out of treatment was hindered and not helped by the majority of the profession. It was his practice to send every case which needed attention to their own doctor if they had one, and failing that to give a hospital note, of which he had a good number at his disposal from the members of his committee. But among the ranks of the general practitioners there were few who cared to undertake an operation for adenoids, or even tonsillotomy; again, a busy practitioner would not have time to give that care and attention to detail which alone can result in the cure of ringworm, itch, impetigo, and the like. In these cases he had utilised the services of a staff of district nurses with great success. He regarded them as his cleansing department, and they did work which he could not expect to be done by qualified practitioners. But even so he did not think that the time was ripe for the school clinic.

It was of course obvious to every thoughtful person that treatment was the logical corollary of examination. It was idle to rave about the socialisation of medicine or to endeavour to put back the clock. Whatever political views were held by those present he ventured to predict that a state medical service would soon, perhaps in their own lifetime, enter the plane of practical politics.

It might have to be a long process of evolution, but one day the system of state medical service would spring fully equipped from the Houses of Parliament, as Minerva sprang ready armed from the head of Jove. Till then the medical officer and the medical examiner would do well not to be led away by fears of socialistic tendencies or by political parties, but amid all his difficulties would endeavour to preserve an even course; being, as Patmore had said,

> " for all
> His days like one who walks the wall
> Of China, and on this side sees
> Cities and their civilities,
> And on the other, lions."

Dr. C. Sanders (West Ham) desired information on a practical point. He had found some schools where it was practically most inconvenient to carry on inspection without interfering with educational work, and recommended his authority to endeavour to arrange for inspection to be carried out in a convenient hall close by; but, on application being made to the Board of Education for permission, the Board replied that they hoped the suggestions in the memorandum would be observed, and inspections carried out on school premises. He felt this decision would materially affect the excellent proposals made by Dr. Boobbyer to his authority.

He felt that on this subject it was most essential to hasten slowly and feel their way. Most of the speakers recognised that ultimately school clinics would be necessary, and yet, with one accord, all those who had had experience agreed that they found little practical difficulty at present. Surely this was due to the fact that the majority of the children were healthy little bodies, and speaking of his own district, which was a large working-class one, he did not as yet see an unusual amount of pediculosis, ringworm, etc.

Dr. Handford (Notts C.C.) deprecated the attempt to introduce uniformity. The system of inspection must grow up gradually as best adapted to English life and to the divergencies of town and country conditions. The general weighing and measuring of children would entail great expense, the preparation of such statistics would be laborious and costly, and the results of moderate scientific value. At present, this part of the inspection would be more usefully confined to well-selected and typical centres. There would be sufficient medical inspection left to occupy the time of the inspector, and to exhaust the funds supplied by the education committees. If each school were supplied with a weighing machine, to be used by the teacher for educational purposes to impress the need of accuracy on the pupils, and to weigh each pupil at the beginning and end of each session, then the matter would be different. The parent could be informed at once of any loss of weight of his child, and could be advised to consult his family doctor. Weighing once in three years could only be of statistical value: a small matter compared with practical utility. There should be no need of a costly medical education to carry out weighing and measuring.

There was no sign that serious objections would come from the parents whose children *had* been inspected. The objections came from an infinitesimal proportion of parents, who had a *prima facie* objection to medical inspection and had no practical experience of it.

It was much to be hoped that rapidity of work, however much it might diminish expenditure, would not be the chief object desired.

The prevalence of pediculosis amounted to a plague; but some months' perseverance in insisting upon a higher standard of cleanliness and self-respect had shown that it was possible to banish pediculosis from school life.

An adequate life-history of the *Pediculus capitis* was much wanted, similar to the work recently done for the common house-fly.

Dr. John Utting (Liverpool) discussed the subject from the point of view of the general practitioner, pointing out that the difficulties of administration only arose when the functions of the school medical officer projected beyond the walls of the school or the precincts of his office. He also emphasised the

necessity of avoiding all invasion of the sphere of the general medical practitioner, pointing out the great assistance that part of the profession had rendered to general sanitation, as evidenced by their cordial co-operation in the efforts of medical officers of health in dealing with infectious diseases. He also remarked strongly upon the question of the socialisation of child life, pointing out that the sphere of parental responsibility was being more and more narrowed. He hoped that the administration of this Act would be as carefully limited as possible to the treatment only of those cases which were hopelessly unprovided for by their proper guardians.

Dr. John Knight (Scarborough) said that, in conjunction with Dr. Smith, he had endeavoured to formulate a scheme which would insure that the physical defects found on medical inspection would receive proper medical attention. Notice of the diseases or defects found would be sent to the parents, and they would be urged to consult the family doctor. After a reasonable interval the school nurse would call to see if any attempt at treatment had been made. Parents who could not afford the necessary medical attention would be referred to the hospital and dispensary. Treatment of diseases like pediculosis, scabies, etc., could be assigned, in needful cases, to the school nurse. Such diseases, in the working classes, seldom came under the practitioner, being mostly dealt with, if at all, by the chemist.

As dental treatment of children was not commonly sought by the working and poorer classes, probably the expense incidental to such treatment could be best mitigated by the appointment of school dentists, who would undertake, in consideration of the large number of children sent to them, to carry out the requisite treatment at a low and uniform fee per head.

Dr. W. G. Savage (Colchester) remarked that he only wished, in discussing the excellent papers read, to deal with two specific points. He wished to emphasise the remarks of Dr. Richards as to the need of allowing the grant for children excluded by action of the school medical officer. He would go further, and would like the grants also allowed for suspicious cases of infectious disease excluded for a few days by school teachers.

For example, in measles one of the best methods of preventing its spread in schools was to instruct teachers to exclude all suspicious cases for three or four days, pending the development of symptoms. In such cases the loss of these days' attendance was much more than counterbalanced by the diminished chances of spreading infection. It was, however, very difficult to get this carried out, owing to teachers being obsessed by the question of attendance; a short-sighted view of attendance, but widely prevalent. As practical men, they must try to combat this difficulty by working to have the attendance allowed in such cases.

The other point was in regard to the treatment of ringworm. In his experience the majority of cases of ringworm in the schools were home treated. Surely they were agreed that home treatment was futile. Home treatment generally meant dabbing on some ink or other absurdity, or obtaining ointment from the nearest chemist. The treatment of ringworm was difficult even with the latest appliances of science, and with the best experience of the medical man. In the same way, treatment by a nurse alone, as suggested by Dr. Knight, was useless.

Again, in regard to the recognition of a cure in ringworm, this was a difficult matter. Dr. Savage remarked he would go further, and suggest that recognition of a cure was impossible in most cases without a microscopic examination, and would advocate that no cases should be readmitted without a certificate after a microscopic examination.

Mr. T. W. Berry (Rhondda, Glam.) urged the importance of appointing clerks to assist the medical officer, both in the office and, more especially, in the school, so as not to take trained teachers from their work, though the moral support and sympathetic co-operation of teachers was assured. It was very desirable to have the work done on the school premises, because the medical man must advise on physical training, recreation, ventilation, lighting, and curricula (from this particular aspect). Nurses should be freely employed, because they could help in developing the parental responsibility and morality. Where culpable negligence was shown parents should be prosecuted for cruelty to children: and when parents who could afford to carry out the medical officer's suggestions did not do so, it should be treated as criminal negligence, and not condoned by the State assuming this responsibility.

Dr. W. G. Willoughby (Eastbourne) mentioned some of the difficulties that had arisen in connection with the work, and how they had been surmounted. He strongly advocated constant co-operation with the general practitioner and the existing hospitals, and other means of treatment now provided. Certain schools were so unfitted for the work that, to prevent interference with the educational work, examination outside, on the lines of Dr. Boobbyer's scheme, would have to be adopted. Among other details Dr. Willoughby emphasised the value of seeing the parents and giving personal advice.

Mr. A. F. Somerville (Somerset Education Committee) said the Somerset County Education Committee had approached this subject from a tentative point of view, and had not attempted to construct a definite system at the present time. It had sought the co-operation of medical officers of health by appointing several as assistant medical inspectors. It had also engaged the services of

nurses of the County Nursing Association to see how far their co-operation would assist the medical inspectors, and so far this had worked well. The school nurse was a most important factor in the successful inspection of children. Teachers had worked loyally; there was no difficulty with parents. The county had adopted a system of devolution by handing over certain work to district committees: it was proposed to entrust to them the supervision of children reported upon by the medical inspector as requiring "after treatment"; and to strengthen these committees by the addition of more lady members. This was essentially a woman's work.

The Act pointed to voluntary efforts for after-treatment. Local hospitals and similar institutions should be used, grants by county councils being made to them. Charities now applied to useless objects might be used for this purpose. There was no grant at present from the Board of Education, but it was hoped there would be in the future.

Mr. Thomas Evans (Glamorgan C.C.) said the remarks he had to make were suggested by the speech of Mr. Berry. He did not wish him and others there to labour under the idea that school medical officers were not awake to the necessity of inquiry into school work in general. In Glamorgan they stepped beyond the strict demands of the education department. After examining about thirty of the admitted and leaving scholars they examined cases submitted by teachers as cases that they thought required medical attention; in this way they got at the children that urgently needed attention. Again, advantage was taken of the opportunity to inculcate into the minds of the children simple rules of health by means of a talk on the care of the teeth, making use of any one of the children to demonstrate the results of neglect, then pointing out how those evils could be avoided by greater care of the teeth. During the interval of play opportunity was taken also to demonstrate to teachers any cases such as adenoids and ear-discharge, and to point out their adverse influence on education.

In this way the school doctor aroused the interest and won the co-operation of the teacher, for without the sympathy and co-operation of enlightened teachers the medical inspection was likely to prove futile.

Also suggestions were made to teachers on the question of dress and physical exercises. As things were at present they found children hampered in their exercises by tight clothes.

Miss Alice Ravenhill (London) spoke of the necessity for considering the general conditions of school life in order to preserve the normal child from developing preventable pathological conditions; that, in the opinion of some, was the first object of medical inspection. She deprecated any suggestion that a clerk should act as clerical assistant to the school doctor in the place of the teachers, whose personal knowledge of the subjects of the examination was

indispensable to the doctor, and drew attention to the necessity for the further training in hygiene and in care of chronic skin troubles, etc., of school nurses, whose hospital experience was often largely confined to acute cases, and who had little opportunity during that period for a study of practical hygiene.

The Hon. Albinia Brodrick (Co. Kerry, Ireland) said she desired to treat the subject from a threefold standpoint, that of the outside public, the school-teacher, and the school-nurse. As regards the public, she thought the whole question might be summed up in the single word tact. Speaking from her experience as a health visitor, she found mothers, with a necessary low percentage of exceptions, very ready to accept suggestions, counsels, and even very unpleasant plain-speaking, if given in the right way. As to the general practitioner, he received an increase of cases, many being sent to him which, but for the advice given by school nurse and health visitor, he would not have heard of at all. She deprecated the addition of fresh burdens to the work of the already overworked teacher. The teachers were responsible for instructing the children in morals, in manners, in cleanliness, and in book-learning; it was impossible for them to undertake matters of health in addition.

It was obvious that the health department must centre round the school-nurse. That was what she was there for. It was her business to report upon the children to the school doctor, and to carry out such treatment as he desired. The difficulty lay in securing a satisfactory and capable nurse. With the present deplorable lack of system prevalent in the nursing world, there was no means of ascertaining a nurse's capacity: she might be a woman with six months' training or one with a three years' certificate. She might be totally incapable and yet rank equally with the best trained of her colleagues. Unlike the medical profession, as mentioned by Dr. Manley, nurses looked to become a State-recognised body at a very early date. A Bill for State Registration of Trained Nurses was before the House of Lords and had passed its second reading. If that Bill did not pass this session it would do so shortly. It was a much-needed measure in the interests both of the public and of the nurse.

It was undoubtedly the fact, as stated by Miss Ravenhill, that a nurse, in addition to her hospital training, required further special training, both practical and theoretical, before she was qualified to act as school-nurse.

Dr. D \. Carruthers (Bucks C.C.) said that he had always found the presence parents at inspection helpful, and he thought good might result not merely by giving advice to them, but also to the elder boys and girls. There were some parts of the schedule that only teachers with their intimate knowledge of the daily conditions of the children could fill up, but it was very desirable that the teacher's work should be reduced to a minimum, and to obtain that end he used books containing leaves of thin paper and stout paper

between which a carbon was interposed, and thus copying was avoided. He had also adopted a scheme of signs which further reduced the amount of writing, as an average condition was shown by a perpendicular line thus , a condition below the average by a minus, and a condition above the average by a plus sign. The difficulty with the weighing machines had been overcome by getting ten machines from Salter with the range of weights marked on a dial in pounds, which were packed in boxes that prevented movement, and were sent throughout the county. He could not agree with the remarks that the medical inspection of school children was taking away work from the general practitioner, because having been a general practitioner he knew that many children, as the result of the inspection, were taken to doctors who but for the report of the inspector would never have seen a doctor; but a word of caution was necessary not to alarm the parents, as they were apt to think when they were advised to take their child to a doctor that he or she must be suffering from a deadly or incurable disease. He could not agree with Dr. Meredith Richards that the superintendent of the asylum was the best consultant in cases of mental deficiency, as he was apt to be pessimistic, but if a consultation was necessary it might be better to call in one of those officers from London who had been doing this kind of work for some time. He might say that on the lines suggested by the proposer of the vote of thanks to their president he had laid the basis of an attempt to obtain a return of all the sickness of school children in the county, and not merely of the infectious disease.

PURE AIR FOR INDOOR WORKERS.

By THOMAS GLOVER LYON, M.A., M.D.Cantab.

THE object of this paper is to call attention to the question of air supply to workers employed in offices, factories, restaurants, &c., and to make some proposals in the direction of reform.

Good air and good food are equally important in developing and maintaining healthy men and women. To eat bad food or to breathe foul air are both injurious, and both establish vicious circles.

Persons accustomed to unwholesome food acquire unhealthy tastes, and in the same way after a time, those accustomed to breathe foul air feel comfortable in a stuffy room, and the least movement of air gives them a feeling of chilliness.

Hence arises one of the many difficulties in providing good ventilation. The condition resulting from bad food is called malnutrition, that arising from bad air still awaits a name.

Besides producing specific results, pallor, anæmia, and the like, bad air is a frequent cause of malnutrition, for it produces a disinclination for exercise with consequent loss of appetite and so forth.

The subject of this paper has become more urgent of recent years. The increased value in large cities of the space occupied by clerks, restaurant hands, &c., has resulted in extra crowding and in the occupation of basements to an extent never before contemplated. It is no exaggeration to say that men, women, boys, and girls at the present moment are working in offices which would be condemned as unfit to shelter a pauper or a lunatic.

The evil effect of these conditions falls most heavily on those indoor workers, who to help make ends meet at home, engage themselves as lady-clerks, typists, or waitresses.

Unable or disinclined to seek recreation in the open air, their lives are spent in ill ventilated offices, underground railways, streets laden with petrol fumes, and stuffy homes.

Some of these are rescued by timely marriage, the rest fall into bad health, some marry later, becoming sickly mothers of degenerate offspring.

Dr. Barwise, years ago, proved that to place workers in bad air is bad economy: it is my intention to deal with the question from a health point of view.

Reading this paper before a society devoted to the advancement of hygiene I feel on delicate ground. Everything connected with such an institution should be an object-lesson. When, however, I call to mind my experiences of congresses such as the present, I find them irresistibly associated with hot and stuffy rooms.

Exhibition buildings are almost always hopelessly bad from a hygienic point of view. Here again it must be remembered that it is the exhibition hands who go about the country from exhibition to exhibition that suffer, not the members of the Congress who occasionally visit the Exhibition.

The same applies to other places of employment, for instance, restaurants. A city man usually snatches a hasty luncheon, and returns to his office, but the waiters and other servants spend the whole day in the atmosphere of the restaurant. I once suggested to a proprietor of a city restaurant that, if good ventilation were provided, his customers would be able to smoke without annoying their neighbours. His answer was, "We don't want them to smoke, we want them to eat their lunch and go."

Restauranteurs are not the greatest sinners in this respect; the pale face of the club-servant is ample evidence of the unhealthy conditions under which he is called upon to pass his days. Innumerable other instances might be quoted, illustrating the point which I wish to emphasise, that it is the worker that must be the main object of our consideration. Much has been done to improve the condition of factories, but much still remains to do.

In most workshops where the hands are crowded together the present regulations are inadequate. It is not uncommon for girls engaged in some industries to faint while at work, and there is always a large number on the sick-list, suffering from anæmia.

Although many of the more enlightened employers of labour are taking steps in the right direction, competition appears to render it hopeless to look for a remedy except by legislation. Nor can it be expected that a good result will be obtained by tinkering up old methods: the whole question must be reconsidered. In the first place, any regulations as to floor space and area of inlets must fail to meet the case. Regulations must be made to insure a proper amount of air at a suitable temperature passing through the rooms where workers are employed; and this air must be properly distributed.

In the next place the position of inspector should be re-adjusted. At

present the task of an inspector is an invidious one. This is largely due to the fact that he is called upon to enforce restrictions which are unnecessary and consequently vexatious. An inspector should be regarded by employers as one who can be counted on to advise them in questions concerning the health of their workers.

This can be arrived at only by formulating a rational scheme of regulations based upon a scientific and thorough inquiry into the necessities of the questions in hand.

Thirdly, an extension of the responsibility of employers is necessary. Official visits of an inspector in the case of private offices would be even more objectionable than in the case of factories, and likely to be of perfunctory nature, and I see no way out of the difficulty, except to make the employer pay damages to his workers if he places them in unhealthy conditions of life and causes injury to their health.

If this were the case, employers would consult the inspector to safeguard themselves. The principle of liability in case of disease is already recognised in the case of a few diseases. This responsibility should be largely extended in its scope so as to embrace all diseases which may reasonably be attributed to employment in unhealthy conditions.

I will conclude this brief attempt to deal with a difficult but important subject, by reference to a specific case which recently came under my notice.

Three lads were engaged, sorting dusty documents by artificial light in a room practically devoid of any means of ventilation. All three had a most unwholesome look, and one had a bandage round his neck suggesting the existence of scrofulous glands. Surely this employer is no less culpable than one who sets men to work a defective machine, and should be no less responsible for the consequence.

Dr. Gerard C. Taylor (Berkshire C.C.), endorsed the remarks of previous speakers with regard to the evil effects of impure air; and drew attention to the difficulty experienced in getting those responsible to make proper use of the means provided for ventilation.

Prof. H. R. Kenwood (London) pointed out that often the workers, rather than the employers, were to blame. In his experience it was the female worker who most frequently seemed to prefer a stuffy atmosphere to a fresh one. When open windows were quite tolerable, it was usual to find most of them closed, and

the other inlet provisions for fresh air were often found to be rendered inoperative. He thought that in many cases this was due to insufficient warming of the workrooms, and he attached a high importance to the warming of such rooms, more particularly because it determined (indirectly) the standard of air-purity it was possible to maintain in the winter months. He had known good, forcible lectures upon the dangers of foul air to bring about a lasting disposition to permit ventilation in some factories where the ample provision made by the employers was rendered almost nugatory by the action of the employees.

Mr. A. F. Somerville (Somerset Education Committee) said that bad ventilation was responsible for a good deal of the drunkenness in the country. The foul air of ill-ventilated public houses had the effect that, even with a small amount of liquor consumed, a man found himself in a state of intoxication when he got into the outer air.

The badly-ventilated condition of our churches produced that soporific effect upon the audience which is often wrongly attributed to the preacher.

The want of proper ventilation of our schools was a matter germane to medical inspection of schools.

A low, well-ventilated room was healthy, while a lofty, ill-ventilated room might be injurious to health.

But where could they find a man who really understood ventilation? Let them find him, and let him give lectures to architects.

Dr. Thomas also took part in the discussion.

CERTIFICATION AND REGISTRATION OF DEATH.

By EDMUND M. SMITH, M.D., D.P.H.,

Medical Officer of Health, City of York.

(MEMBER.)

THAT bodies should be buried without *full* medical certification as to cause of death is a very unsatisfactory state of things. The certification of the cause of death by medical practitioners is at present frequently unsatisfactory, being either incomplete, or, owing to the certificate not being a confidential document between the practitioner and the registrar, partially inaccurate, *e.g.*, deaths from alcoholism, venereal disease, &c.

The present condition of things with regard to the burial of stillbirths is also most unsatisfactory, not only from a statistical point of view, but because there is a very large open door for criminal concealment of birth.

What is the remedy for these serious deficiencies in the present law?—

(1.) That the body of a person who was born, living or dead, after the seventh month of pregnancy, should not be buried except after registration of the certificate of a qualified medical man, or of a coroner, or of a public medical certifier (say, the local police surgeon). There would then be no uncertified deaths, and all stillbirths would be registered, at any rate as deaths. Burials should only take place in public cemeteries or churchyards.

I think also that stillbirths should be registered as births. In that case, for some years to come, the totals of registered stillbirths as births and of registered stillbirths as deaths would have to be stated separately so as to be distinguishable from the births and deaths registered under the present law, otherwise our totals of births and deaths in future years could not be compared with those for recent years. But that is not an insurmountable detail.

(2.) All medical certificates of the cause of death for the purpose of registration should be paid for by the national exchequer, and delivered or posted to the registrar by the practitioner *direct and under sealed cover*. The law could then insist upon the cause of death being stated completely and with the utmost accuracy, and there should be only one legal form of certificate, the use of which should be compulsory. Furthermore, the law could insist that the certificate should state that the practitioner had seen the body after death, or that he had verified the death on the signed testimony of at least two witnesses at death.

It has been estimated that a sum of about £100,000 would cover the national cost of a reasonable fee for medical certificates of cause of death.

This important matter was reported upon by a Select Committee of the House of Commons in 1893, who made recommendations as to the amendment of the law upon the lines I have mentioned; it was also prominently referred to in the Report of the Commission on Physical Deterioration in 1904; and contributions to the subject have also been made by Dr. Walford of Cardiff, Dr. Snell of Coventry, Dr. J. R. Kaye, and others, but nothing has at yet been done.

The percentage of the "uncertified deaths" (of the total deaths in England and Wales) has declined from 4·85 in 1878 to 1·53 in 1906 and 1·40 in 1907, and yet there were no fewer than 8,114 uncertified deaths in England and Wales in 1906, and 40·5 per cent. of those were of children under the age of one year. Of the latter, 70 per cent. were under the age of three months, and 22 per cent. of these (as compared with 40 per cent. in previous years) were not referred to the Coroner.

The abolition of "uncertified deaths" would help to put a stop to the practice of unregistered medical practitioners, to the neglect of sick children and aged persons, to carelessness during pregnancy, and to the appalling death-rate of illegitimate children.

I don't think I need dilate further upon the subject; the need for reform is obvious to all. What is now wanted is action.

ALDERMAN JOHN TODD (Gateshead-on-Tyne) said it was absolutely necessary in order to get accurate and full certification of death that medical men should be paid for the death certificate, and that the certificate should be sent to the Registrar under cover.

Medical men would feel greater responsibility when giving a certificate if they were doing work for which they were paid.

If certificates were sent under cover, such diseases as syphilis and alcoholism would be accurately stated, which is not done at present.

The Mayor of Jarrow (Mr. Thomas Ramsey) who is a registrar, pointed out that it would be no advantage to put the certificate under cover, unless the Registrar-General was also asked to instruct the registrars to make some modifications in the form of the certificate at present given by them to the relatives, because the registrars copied on that certificate what the doctors stated to be the cause of death.

Dr. Spottiswoode Cameron (Leeds) said that going over in detail the recommendations of the Select Committee of the House of Commons in 1899, he pointed out that if, as was very desirable, a public medical certifier were appointed, his duties should include the investigation of imperfect certificates as well as the cause of uncertified deaths. Too frequently the hurried practitioner left out the duration of illness, and when the medical officer of health came to classify the death, it was not always easy, without that information, to tell from the certificate itself which was really the primary and which the secondary cause of death. Generally medical officers understood by the primary, the chief cause of death: usually this was the condition of longer duration, but some practitioners placed the immediate cause of death first and the real disease second. Dr. Smith proposed to add to recommendation 2, which suggested that the certificate of death should be sent direct to the registrar, a rider that it should be under cover. In any case, Dr. Cameron agreed with the Mayor of Jarrow that the Registrar-General should not sanction the copying in full of the causes of death in the certificate for insurance societies. If those societies required information of this kind for actuarial purposes, they should obtain it from the Registrar-General or the medical officer of health. If they required it for preventing fraud they should obtain their evidence otherwise. If a man was insured who believed himself well, and in whom the medical examiner of the insurance company could find no evidence of disease, his relatives were entitled to the benefit.

Dr. Edmund M. Smith (York) moved a resolution embodying the recommendations made in his paper. This resolution, drawn up by Dr Spottiswoode Cameron and himself, was based upon the Report of the Select Committee of the House of Commons in 1893. He made no imputations upon registrars of deaths, who, in his experience, were a most intelligent and honourable body of men. Contrary to one of the speakers, he believed cremation to be the best form of disposal of the dead. He considered that if more complete and accurate certification of the cause of death was to be demanded, as was most

desirable, it was only fair and expedient that the practitioner should be paid a proper fee for his certificate. It had been estimated that about £100,000 would cover the national expenditure in paying sufficient fees, a mere bagatelle in the nation's expenditure.

After some further discussion it was Resolved—

"That in the opinion of this Conference it is desirable that the Government should be urged to take steps to amend the law with reference to the registration of births and deaths."

Ald. Flowers, Mr. Challoner, Dr. Willoughby, and Dr. Vachell also took part in the discussion.

EXAMINATION OF SAUSAGES AND THEIR HYGIENIC PREPARATION.

By WILLIAM G. SAVAGE, B.Sc., M.D., D.P.H.,
Medical Officer of Health and Public Analyst, Colchester.

The Examination of Sausages and their Hygienic Preparation.

Sausages are always something of the nature of a mystery. By popular tradition all manner of unlawful substances, from poor quality meat, at the best, to horseflesh and cats, at the worst, are supposed to go into them. Certainly, from their very nature they invite the use of substances which would be rejected if vended in any other way.

Also not a few cases of food-poisoning have been traced to their consumption. That more cases of disease are not ascribed to their use is, I believe, owing to the fairly efficient cooking which they generally receive.

There can be but little doubt that their preparation should be subject to considerable supervision.

There seem to be no definite guiding standards in this country either as to their composition, the presence and amount of preservatives or their bacterial content. The following remarks may therefore be of use in connection with this subject.

The Composition of Sausages.

Sausages are usually composed of good meat (pork or beef) finely minced, mixed with spices and flavouring agents such as salt, pepper, sage, while usually some bread or starchy material is added. They generally contain rather over 50 per cent. of water. The mixture is placed in a sausage machine, an apparatus by means of which the finely-minced mixture is forced out in long cylindrical masses into casings of intestines.

From a sanitary point of view the meat used may be either of poor quality: meat in an incipient state of decomposition; from a diseased animal: from an animal, other than pig or bullock, such as horse. Also the meat used may not be from the musculature, but from the visceral organs.

The spices and flavouring agents added would tend to mask early decomposition. All the sausages which I have examined have been made from ordinary muscle meat, but in Germany visceral sausages are

important articles of sale. Visceral sausages (lungwurst, leberwurst, &c.), are of considerable nutritive value, but they are subject to two serious hygienic objections (*a*) the viscera are prone to rapid deterioration and decomposition and the sausage must be eaten freshly made (*b*) the organs used, especially the liver and spleen, are more likely than muscle meat to contain pathogenic organisms rendering such sausages liable to distribute disease.

In Germany where the habit of eating raw or but little cooked sausages is still practised, such sausages are particularly potentially dangerous.

I have no means of judging to what extent horseflesh is used in sausages in this country. It provides a firm filling of high nutritive value and hygienically would seem to be unobjectionable. Of course, however, sausages so composed should be distinctly labelled as such.

A very general practice, but as regards Colchester not an invariable one, is to add a small quantity of starchy material, either as bread, flour or biscuits, to sausages. I have usually found that bread is added, but according to Ostertag, flour is frequently substituted, at least in Germany. There would seem to be no objection to this addition provided it is not in quantity sufficient to seriously diminish the nutritive value of the sausages.

In addition to the above, colouring matters sometimes, and preservatives frequently, are added to the sausage meat. The preservative most commonly added is boric acid or its compounds. Less commonly salicylic acid, benzoic acid and the sulphites are used.

Convictions have been obtained for sausages containing 30, 40 and 60 grains of boric acid per pound.

In the sausages which I have examined those taken in the cooler months of the year contained no preservatives, but in the hot weather boric acid has usually been found. I have not found more than 30 grains per pound in any of the samples. If allowed at all, 0·25 per cent. (about 17 grains per lb.) should not be exceeded. Sausages should be sold and consumed soon after their preparation, and there seems no reason why any preservatives should be allowed.

The Bacterial content of Sausages.

I am not aware of any investigations dealing with the bacterial content of sausages. The actual number of bacteria present is of secondary import, but it is of value to see how far intestinal organisms are present in them, as purchased. For this purpose I have recently examined a number of sausages obtained from 12 different shops. In every instance the sausages were made upon the premises. They were all free from preservatives.

The outside skin was sterilized by a cautery, the sausage cut open by a sterile knife and, by means of a fresh sterile knife and forceps, 2 grammes from the middle were accurately weighed into a bottle with an india-rubber stopper containing 20 cc. of sterile water. After thorough mixture various quantities of the emulsion were added to lactose bile-salt and other media tubes while in several instances ·1 cc. was distributed direct over the surface of a lactose bile-salt agar plate. The results as regards the number of *B. coli* are shown in the Table.

Number.	Number of *B. coli* per grm. of Sausage.	When Sausages made, in relation to Sampling.
1	10—100	Same day.
2	More than 100	Previous day.
3	,, ,,	Same day.
4	,, ,,	,,
5	,, ,, (600)	,,
6	,, ,, (100)	,,
7	,, ,, (5,800)	,,
8	,, ,, (60,000)	Sausage meat previous day, filled in, same day.
9	,, ,, (120,000)	Same day.
10	,, ,, (2,500)	,,
11	,, ,, (45,000)	,,
12	,, ,,	,,

This Table shows that *B. coli* were present in every case and were frequently in very large numbers. A smaller quantity than 0·1 cc. of the emulsion, equivalent to ·01 grm. of sausage, was not examined, but in all, except the first specimen, this quantity contained *B. coli*. That is in 92 per cent. there were more than 100 *B. coli* per grm. In seven instances, by brushing diluted fractions of the emulsion over lactose bile salt neutral-red agar plates the exact number of *B. coli* could be more nearly determined. In these instances the numbers per gramme are shown in the table in brackets.

Most of the sausages were quite recently made. These results show that even with quite freshly prepared sausages *B. coli* is always present in large numbers. The *B. coli* had the typical excretal characters.

Ordinary musculature, bread, and the other constituents of sausages in their pure state do not contain *B. coli*. This bacillus is the distinctive organism of excreta, and the fact that it was present in such large numbers indicate that the sausages were in an unsatisfactory state as regards hygienic purity.

That sausages should be free from *B. coli* even per gramme is a hard saying, and probably quite impracticable to enforce in practice, but their

presence in such large numbers is evidence of an undesirable want of cleanliness. The framing of any standards is made difficult by the fact that *B. coli* multiply rapidly in sausages.

In connection with the bacteriology of sausages, the bacterial content of the "skins" is deserving of attention.

The sausage casings are usually purchased dried and packed in salt, but sometimes they are used comparatively fresh.

A firm of gut-scrapers within the borough of Colchester, who do a very extensive business in these dried guts for sausage-skins, prepare them in the following way:—

The guts are scraped and then transferred to pickle consisting of a weak salt solution. They are left in this pickle for 24 hours or so, transferred to fresh pickle of similar composition; then next day to fresh pickle and again the next day. Finally, after a day in the last solution they are placed in a stronger pickle. After about 24 hours in this solution they are roughly measured by hand, transferred to a table, dry salt rubbed well into them, wrapped up into bales, packed in boxes, and sent all over the country.

The period from fresh gut to dry gut mixed with salt takes therefore rather less than a week, the guts being transferred daily from one brine solution to another. No exact strength of pickle was used, the solutions being only roughly made, *i.e.*, two handfuls or so of dried salt added to an ordinary sized barrel half full of water.

I have bacterially examined a number of the dried sausage-skins supplied by this firm, and none of them contained *B. coli*. The procedure adopted would seem to be sufficient to eliminate intestinal organisms.

In a number of instances, however, I have come across sausage-makers who prepare their own sausage-skins direct from the slaughtered animals and use them in a very fresh condition. This is a most objectionable practice. In these cases the guts were washed out with water several times, placed in a little salt and water, and used wet, perhaps two to three days after being obtained. A consideration of the histological structure of the small intestine will make clear the great difficulty in washing away all bacteria from its interior. Also, as we know, pathogenic bacteria in the intestines are more frequently met with on the mucous membrane than in the actual contents. Such cleaning is quite insufficient to wash away all organisms, and should the guts be derived from a diseased pig, as might well be the case, harmful pathogenic bacteria would be contained in the skins as used.

That this is not improbable is shown by the results of the examinations made. Separate samples of the casings used were collected in sterile

bottles. In all nine instances in which dried skins packed in salt were used *B. coli* were absent (1 inch of "skin" examined).

In the remaining three instances (25 per cent.) freshly-prepared sausage skins were used. In all of these *B. coli* were readily isolated.

In numerous instances sausages have given rise to isolated cases and also to extensive outbreaks of poisoning. These meat-poisoning outbreaks, from a bacteriological standpoint, are, broadly speaking, of three different kinds, and all three have been met with caused by sausages: (*a*) due to toxins produced by the ordinary bacteria of decomposition; (*b*) due to infection with certain members of the Gaertner group; (*c*) due to infection with *B. botulinus*.

In the first group are included the cases of poisoning due to the sausages having undergone some putrefactive changes, possibly in the meat before being made up into sausages. Cases of poisoning from this source would be usually mild and more or less isolated, no widespread outbreaks resulting.

The second group of cases are much more serious, and are due to infection of the food with living bacteria, of which *B. enteritidis* (Gaertner) is the organism most commonly found.

These organisms produce heat-resisting toxins, so that even if the sausages are properly cooked the undestroyed toxins already present may be sufficient to produce symptoms.

If owing to insufficient cooking or smoking the interior of the sausage is not raised above the death point of the bacilli (60—70°C.) living bacilli may be ingested, and severe illness result. In such cases there is usually a more or less definite incubation period, the symptoms are pronounced, sometimes fatal, and the blood of the affected patients will agglutinate the bacilli causing the outbreak.

The fact that the bacilli of meat poisoning may survive in sausages only moderately well cooked is illustrated by the following experiment: Three sausages were purchased, and all three inoculated with a Gaertner bacillus isolated recently by the writer from a fatal case of meat poisoning.

After inoculation the sausages were incubated for about 20 hours so that the infection would be very massive.

One sausage was kept as a control, the other two were fried in a frying-pan in the ordinary way, one lightly cooked and the other fairly well cooked. All three sausages were then bacteriologically examined, and the Gaertner bacillus was very readily isolated from all of them. In both instances the cooking was insufficient to kill the meat-poisoning bacilli in the interior of the sausages.

B. enteritidis is especially liable to infect pigs, causing definite symptoms. In such cases the bacilli are usually also present in the intestinal contents, so that the danger of using guts in an imperfectly cleaned condition is a very real one. Even if the sausage meat is itself free from objectionable bacilli, the bacteria from the infected casing will rapidly multiply and make their way to the interior of the sausage, and, with imperfect cooking, may there survive.

The third group includes the cases of so-called *botulism*. As far as I know cases have not been recorded in this country. They have occurred chiefly in Germany, and particularly in Würtemburg. In the latter country it was formerly very prevalent but is now comparatively rarely met with. It was mainly caused by the use of liver and blood sausages, improperly cooked or smoked and kept for an undue period. The symptoms come on twenty-four to thirty-six hours after a meal. Due to *B. botulinus* an anaërobic organism producing powerful toxins. According to Ostertag this bacillus will not develop in six per cent. of common salt, so that ordinary pickling will prevent its development.

The action of sodium chloride upon bacteria is a very weak one, and brine solutions have to be both fairly concentrated and prolonged in their action to effect the death of pathogenic bacteria.

The following experiment illustrates the inefficiency of a ten per cent. solution. Diluted traces of agar cultures of *B. coli* and a Gaertner meat poisoning bacillus (*Meirelbeek* strain, isolated from the Meirelbeek outbreak) were added to accurate ten per cent. solution of sodium chloride. The actual number of organisms added was carefully estimated. There were 184,000 *B. coli* and 210,000 *Meirelbeek* respectively in the whole 10 cc. of each ten per cent. salt solution. After twenty-four hours' incubation at 21° C. the numbers were again estimated and showed 180,000 *B. coli* and 148,000 *Meirelbeek* in each 10 cc. In other words, the action of ten per cent. salt solution (about the usual strength of brine solution) for twenty-four hours was nil, no appreciable diminution of the organisms having taken place. After six days at the same temperature, however, both solutions were sterile.

Hygienic Condition of the Premises.

It is important to inspect sausage-making premises to see that they are clean. The ordinary type of sausage machine permits the cylinder to be taken out and the whole apparatus thoroughly cleaned under the tap. Most sausage makers can be relied upon to do this, but in one instance in the course of inspection I found a sausage machine quite dirty and containing admittedly two days old sausage meat.

Frequently insufficient care is taken to keep the sausage skins clean, and on several occasions I have found them placed in pieces of newspaper, only partially covered, and kept on the floor.

Examination of Sausages from a Hygienic Point of View.

For a determination of the nutritive value the fat, proteids, starch water, etc., must be estimated, but from a sanitary point of view a different procedure is required. Such an examination should be bacteriological, chemical and microscopic.

(*a*) *Bacteriological.*—Insufficient work has been done to determine what value is to be attached to a bacteriological examination, but I think the number of *B. coli* present per gramme of sausage should be determined. The procedure described above would be suitable. Also the presence of organisms of this class in the gut used for casings should be determined.

An examination of the sausage meat for members of the Gaertner group should also be made. The method devised, by the writer to be published in the forthcoming report* of the medical officer to the Local Government Board is in my experience a very suitable and reliable one.

(*b*) *Chemical.*—Sausages should be tested for the different preservatives mentioned above and, if detected, the amounts estimated.

Commencing putrefactive changes may be sometimes detected by boiling up a part of the sausage with water and when boiling adding freshly made lime-water. Decomposing meat yields an offensive ammoniacal odour contrasting with the faintly ammoniacal odour of fresh meat. I have not found this test very sensitive. Starch can be tested for by the iodine test and if necessary estimated by inversion. I have had no experience of chemical tests for horseflesh, but these might be useful.

(*c*) *Microscopic.*—The presence of added starches in the form of bread, flour, potatoes, etc., can be readily detected by microscopic examination of the finer debris obtained after mixing sausage meat with water. The larger pieces should be cut into sections with a microtome and examined. In this way the presence of liver, kidneys or other viscera can be readily detected. Assistance may also be obtained from such sections as to the existence of decomposition of the meat and the presence of abundant bacteria.

By these methods it is possible to obtain considerable evidence as to the hygienic purity of sausages.

* In the Press.

I shall be glad to hear the experience of others who have examined sausages in this way, and particularly as to the possibility of framing some standards by which the purity and wholesomeness of these articles of food can be judged.

Prof. Kenwood (London) stated that the common defence of the use of chemical preservatives in "fresh" sausages sold by butchers was that it was necessary to provide for maintaining them, all the year round, in a fresh condition for four or five days. He wholly dissented from that view; and he would like to hear Dr. Savage's opinion as to whether the reasonable limit to the time within which such material should be consumed was not determined by its keeping powers in the absence of chemical drugs, as was the case of the meat, &c., from which the sausages were prepared.

The bacteriological results were interesting and gave food for thought. Could Dr. Savage account for the exceptionally high figure of B. *coli* in one of the samples? Was the sausage meat packed in a fresh skin? Did any of the samples reported upon contain preservatives; and if so which samples?

Dr. Spottiswoode Cameron (Leeds) also called attention to the hygienic, or rather unhygienic, condition of the works. In a case of poisoning from "savoury duck" in Huddersfield, when some twenty persons suffered from choleraic diarrhœa, one fatally, they found a set of tuberculous lights on one of the hooks at the workplace and got the occupier fined. In a case of potted meat poisoning in Leeds they found the confectioner's cellar and bakehouse to be in a bad sanitary state. Going further back in this case he suspected the butcher's shop was worse than the confectioner's workshop. There was a chilled meat safe into which the butcher was in the habit of transferring pieces of meat which had already shown signs of going wrong. He was inclined to think that the checking of external manifestations of decomposition concealed the more dangerous changes from toxine-making bacteria within. The late Oscar Liebreich defended the introduction of boric acid into the Frankfort sausages. Was it not, however, likely that the antiseptic action of boric acid in sausages, as in milk, was to limit the growth of the lactose-fermenting bacilli, while leaving the more dangerous proteiolytic bacteria unaffected. We know that milk treated with boric acid, instead of turning sour early, is apt to go putrid later, all at once, like the "one horse shay." Personally, however, he would be glad to get rid of sausages altogether. The gut scraping was offensive, and the finished article a serious source of danger to the consumer.

The Mayor of Crewe, Dr. Sergeant, Dr. Willoughby, Dr. Edwards, Dr. Moore, Ald. Wilson, and Capt. Edwards also took part in the discussion.

THE MUNICIPAL TRAINING OF CONSUMPTIVES.

By J. HOWARD-JONES, M.D., C.M., D.Sc.,
Medical Officer of Health, Newport, Mon.
(MEMBER.)

IT is generally acknowledged by all competent authorities that the chief vehicle of infection in human tuberculosis is the sputum from cases of phthisis; that being the case it is the duty of sanitary authorities to direct their efforts towards educating consumptives in all matters pertaining to the prevention of infection. To attain this object it is first necessary to find the victims *early* and then to educate them.

These problems are difficult to solve, and as the Congresses of The Royal Sanitary Institute afford excellent opportunities for comparing and criticising the methods adopted by various authorities, a short account of our experiences at Newport may serve as a means of ventilating this very serious and often much neglected branch of public health work.

The phthisis death-rate at Newport has come down gradually from 2·7 to ·96 per 1,000 per annum of the inhabitants during the last 35 years, but we estimate that we have among us *to-day* 250 to 300 consumptives. There is therefore ample work for us to do as a sanitary authority.

Five years ago we adopted the voluntary notification of phthisis, with the same scale of fees as obtains under the Notification of Infectious Diseases Act. Notification was followed by a system of visitation by health visitors, with verbal and printed information and disinfection. The cases notified by medical men during the years 1903 to 1907, inclusive, were 23, 14, 19, 39 and 19 respectively.

During five years 114 cases were notified, whilst the deaths numbered 380; thus only 30 per cent. of the fatal cases were notified. When we consider that a large number of cases recover, especially from first attacks of the disease, the proportion of notified cases could not be considered at all satisfactory. We also found that the majority of the cases notified were in an advanced stage of the disease.

In my Annual Report for the year 1904 I recommended the utilisa-

tion of one of the isolation blocks at the fever hospital, which owing to the comparative freedom of the town from diphtheria and typhoid fever had been unoccupied for nearly two years, as a sanatorium for the training of consumptives.

The scheme was taken up in 1905 by the Corporation, and a small deputation which visited the Brighton isolation hospital, where such a scheme had been started, reported very favourably respecting the work done there.

It was decided to use six beds for the purpose of giving consumptives a month's training in the principles of sanatorium treatment and prevention of infection. However, no sooner had the scheme been adopted than measles and whooping cough broke out concurrently with scarlet fever, with the result that all the isolation blocks had to be utilised for cases of the latter complicated by attacks of measles, whooping cough, or chickenpox.

The sanitary authority, however, were serious in their desire to provide beds for cases of phthisis, and took the opportunity of purchasing the temporary accident hospital erected at Avonmouth new docks by the contractors, and was for sale. This was moved to Newport and re-erected on the fever hospital grounds as a sanatorium block for phthisis.

Previous to the opening of the block a circular was forwarded to all medical practitioners drawing attention to the matter. A few extracts from this circular will explain the principles upon which the scheme is being worked.

"Necessarily one of the conditions of admission is the previous notification of every case by the medical attendant."

"Owing probably to the fact that only the advantages of advice upon home hygiene and general preventive measures could be offered to patients for the notification of their unfortunate condition, voluntary notification has been a very partial success; but now that patients will have a chance of a month's free residence and training at the Sanatorium, I trust that voluntary notification will become generally adopted in respect to phthisis."

"It is not intended to confine the use of the Sanatorium to those in the early stages only, as a month's training in the precautionary measures necessary to prevent the infection of others will be a public advantage even if the patient's condition does not justify the hope that the treatment would be of a permanent advantage to the patient. At the same time it is highly desirable that cases which are likely to die in the course of a few months, or are in such a condition that they cannot be discharged at the end of the month's treatment, should not be sent to hospital."

"The Corporation have placed six beds at the disposal of the Hospital Sub-committee; these beds will provide accommodation for the treatment of 72 patients (male and female) during each year, and the Committee look forward with confidence to the result, both in the direction of a reduction in the prevalence of the disease, and of placing patients on the road to recovery, particularly those in the early stages of the disease."

It is decidedly early yet to speak of results: but we have discovered two facts: First, that there is a decided demand for such an institution, for at present there are six patients waiting admission; secondly, that the objections to notification have been removed to a very great extent.

From January 1st to March 18th six cases of phthisis were notified. From the latter date until June 18th forty cases were notified. We also anticipate that early notification will become the rule instead of the exception in reference to phthisis. The chances of recovery will then be increased.

Before concluding the writer would emphasise the following points in reference to the municipal training of consumptives.

Consumption is the most serious of the infectious diseases which we have to fight with.

In order to grapple with the problem satisfactorily it is absolutely necessary to train those affected by the disease in the methods of prevention.

Voluntary notification, without some popular scheme of municipal training, will not become general.

Where infectious diseases hospitals have been established, sanatoria for the training of consumptives can be provided at a comparatively small additional cost owing to the fact that the chief establishment and administrative machinery is already in existence.

[*For Discussion on this Paper, see page 380.*]

SOME DIFFICULTIES IN ADMINISTRATIVE METHODS IN CONNECTION WITH THE TREATMENT OF EARLY CASES OF PHTHISIS.

By J. D. McCRINDLE, M.B., D.P.H.,
Medical Officer of Health, Northampton.
(MEMBER.)

THE history of the preventive measures adopted by the municipality against the spread of consumption in Northampton is much the same as in other towns, up to a certain point.

It is, of course, hardly yet long enough since the inauguration of the more direct methods to allow of a proper estimate of their value, but some of the weak points are beginning to show themselves, and at a congress such as this a discussion on some of these practical difficulties should be very useful.

A short sketch of the work carried out in the town of Northampton in recent years in the crusade against tuberculosis, and an attempt to estimate some of the results of such work, may be an instructive preliminary to further consideration.

Voluntary notification of cases of phthisis came into operation in October, 1900, and since then 547 cases have been notified up to the end of last year; compared with 765 deaths registered in a population of 87,000 at the last census, and estimated now to be about 93,000. There is, therefore, no small amount of consumption to be dealt with.

The voluntary system, judged by these figures, has been fairly satisfactory, and shows signs of improvement recently. Previous to this system of notification, a long and vigorous crusade against insalubrious property had been carried out, which had, and must still have, a decided influence on the spread of the disease.

Every notified case has been visited as soon as practicable after notification by an official of the Health Department, and the circumstances

attending it have been recorded. Further, a system of quarterly re-visits has been kept up, and in this way educative efforts have been attempted on a somewhat systematic plan.

Over two years ago 10 beds were set apart at one of our isolation hospitals for the accommodation of advanced cases of phthisis. The object of this was preventive, only the cases deemed to be the most dangerous in spreading the disease being admitted. Thus about 12 per cent. of the deaths which occurred in the town during the last two years have taken place in this institution after varying periods of isolation from the rest of the community.

About the same time a still further effort was made against the disease. The Council resolved to pay for the sanatorium treatment of a proportion at least of the early cases, in the hope that the town might benefit by the cure or the considerable prolongation of the economic usefulness of some of its townspeople.

Northampton is almost entirely an industrial town, standing alone (except for a few comparatively small and scattered townships) in the centre of an agricultural country. The principal industry, almost the only one of any importance, is the making of boots and shoes. A very large proportion of the inhabitants are operatives in connection with this industry, which of recent years has not been so thriving as formerly, and therefore the prosperity of the community is not what it used to be. In view, therefore, of the recent growth of municipal expenditure in almost all directions, causing a rise in the local rates, the reaction in favour of a rigid public economy has set in strongly in the town. Every department of municipal administration is being weighed in the balances to determine if it is worth the money it costs. Amongst others the efforts for the gradual suppression of phthisis are coming in for criticism, and especially the value of the sanatorium treatment amongst the early cases at the public expense. A little over two years only has elapsed since this was begun, and it has only been attempted on a small scale. At first 6 beds, 4 for males, 2 for females, were reserved for the town's cases at Kelling Sanatorium in Norfolk. The initial selection of the patients, from amongst those notified whose financial circumstances precluded their going at their own or their friends' expense, was left to the medical officer of health. From these the final selection was made by a medical referee in the town, appointed with the approval of the sanatorium authorities. The cases were to remain at the sanatorium as long as the medical superintendent thought it desirable in each particular case. Difficulties arose from the first in getting sufficiently early cases notified and selected, as it was hoped

that only such early cases, where there was every prospect of the cure or arrest of the disease, would be sent. Rather than pay for empty beds many of the first cases sent were not considered such as would benefit to the desired extent, and the immediate after results were disappointing.

Consequently, the council terminated its agreement with the Kelling Sanatorium after the first year, and set aside £300 annually with which to send cases to any sanatorium which would receive such without special reservation of beds. Almost the only institutions conveniently situated, which were prepared to receive odd cases in this way, were the Kelling and the Maitland Cottage Sanatorium in Oxfordshire. These being generally well filled, beds could not always be got when they were wanted.

Almost as soon as this latter arrangement was made, early cases became more frequently notified, and suitable cases are no longer difficult to find, and it is becoming apparent that a much greater fund than is at present set aside could be easily made use of.

Since the sanatorium treatment was started 29 cases have been sent by the town to one or other of these two sanatoria, and all but 4 have returned; the first, in September, 1906, and the last in March of the present year. Of the 25 cases returned the average stay in the sanatorium was 91 days, the longest stay was 180, and the shortest 50 days. All of them returned within the period included between September, 1906, and March, 1908 (*i.e.*, from twenty-one to three months ago). The results, however, are, I think, a little disappointing. Of these 25, 4 are already dead, 2 have been removed as cases in the last stages to the isolation hospital, 5 are decidedly worse than when they entered the sanatorium, in spite of distinct temporary improvement as a result of the treatment, and have done no work since they left. This accounts for 11, or 44 per cent. within little more than eighteen months. The remaining 56 per cent. are for the most part maintaining their improved condition so far, and are working and adding to the wage earning community, or are capable of doing so. Such results, during the brief period that has elapsed up till the present, of the early treatment of phthisis do not seem to me to be too encouraging, even considering the type of case sent during the first year. In looking over the notes I have on the history of each case, I find that only 4 could be said not to have derived distinct immediate benefit from the sanatorium treatment, and these 4 were not considered good cases from the beginning; 3 of these are dead, and the other is in the last stages. In 21 of the other 25 cases there seemed reasonable prospect of better results. Hence a large part of the failure has been mostly due to lack of after care. For this part of the treatment no public funds are

available, and I believe the weak point in our work has been found. An attempt was made at first by the local branch of the Society for the prevention of the spread of consumption to establish an after-care committee.

The idea was to bring together the patients returned from the sanatorium, and employers of labour who were willing to offer employment of such a nature as would allow the returned patients to maintain their improved condition, and at the same time earn their living and that of their dependents. The efforts of this committee, without the funds to supply temporary relief pending the necessary negotiations, proved abortive, and the attempt has been given up. Many of the patients have had to return to their old employment in order to live and support their dependents, and the old conditions of life have been resumed, with disastrous results. The result of this is, that at present in selecting cases for sanatorium treatment the social conditions weigh almost as much as the physical, and cases eminently suitable physically have to be rejected because there is no prospect of their being able to maintain the improvement when they return from the sanatorium. It is no unusual thing to find a man with commencing phthisis, whose physical signs offer every encouragement to hope for a complete cure, if he can only be got away from his surroundings and his work for a complete rest at a sanatorium, and afterwards easy open-air employment for a further period. But such a man often has a wife and family whom he cannot be persuaded to leave to the parish or the C.O.S., especially when, as in the early stages, it is difficult to convince him he is really ill.

The public funds set apart are small enough at present, but with such a record of results so far one hesitates to advise a community, by no means wealthy, and already heavily burdened with expenditure, to substantially increase the vote for this purpose.

This is the chief difficulty found in Northampton at present in connection with the treatment of early cases of consumption at the public expense, and if the experience of others under similar circumstances is brought out in the discussion, which I trust I may now introduce, I look forward to it with some hope and much interest.

[*This Discussion applies also to the Paper by* Dr. J. Howard-Jones, *page 374*].

Dr. C. Killick Millard (Leicester) said that at Leicester the practice of providing hospital accommodation for consumptives was begun four and a half

years ago, and some hundreds of cases had been treated. At first the Brighton system was followed, and cases were kept in hospital for one month only, the object being merely educational. After two years' experience, however, it was decided that when cases gave sufficient promise of permanent benefit they should be kept in for two, three, and sometimes four months. It seemed a great pity not to make an effort to save such cases.

From the educational point of view there was a great advantage in treating cases locally at the isolation hospital rather than sending them away to a distant sanatorium. The effect of seeing the consumptive patients undergoing the open-air treatment constituted an important object lesson for the numerous visitors to an isolation hospital. It was also a great advantage from a financial point of view as it cost very much less, all the administration expenses being already provided for.

From a curative point of view the results were encouraging if we did not expect too much. The difficulties were great, especially in the case of the working classes, so many cases relapsing after they returned home. On the other hand some cases could undoubtedly be saved.

Dr. T. Morrison Clayton (Gateshead) said that in Gateshead voluntary notification had been in force for six or seven years, but in view of the decreasing numbers notified each year he could not regard it a success. They had their patients treated at Stanhope sanatorium, and in a report of fifty patients treated something like 60 per cent. returned to work. Surely that prolongation of life was worthy of all the outlay.

Dr. Lloyd M. Bowen-Jones (Carmarthen) said that he looked upon the advantages of sanatoria with only twenty beds more as educative to the poor than as a curative measure for the large number of cases existing. Patients considered phthisis due to cold, and therefore stopped up all inlets of fresh air, besides that the patients would be taught to work in the sanatorium so as to be able to resume their ordinary occupation when they returned.

Voluntary notification was not found of any use as no cases were notified.

Dr. J. Spottiswoode Cameron (Leeds) said Leeds had had notification (voluntary) for some eight years. The number of notifications received had steadily increased until it now nearly equalled the deaths recorded. Special instructions had been issued to the inspectors who visited the house not to harass the patient or his friends. Though disinfection from time to time was advised, it was not insisted upon against the wish of the relatives. The neighbours were not told that they must avoid the house, and the patient was not prosecuted if he took a cab.

There were two voluntary hospitals, one outside the town for the milder or

earlier cases where there was the greater hope of permanent recovery, and one in the town where the less hopeful cases could be isolated. In crowded houses it was a great advantage to be able to remove, even for a time, and train in methods of safeguarding others, such advanced cases. If they improved they might be transferred to the outside sanatorium. Paper spittoons were provided for the use of patients remaining at home, and they were instructed as to their use, as well as in regard to other precautionary methods. He regretted that the Local Government Board still so far distrusted the discretion of medical officers of health and their authorities as to refuse to allow compulsory notification without the "ifs and buts" inserted into the Sheffield clause.

Alderman Flowers (Newcastle) said that there was a difficulty in notification for fear of the sufferer being boycotted by his fellow-workmen: he considered four weeks too short a test, but that thirteen weeks was long enough to test the cases in a sanatorium. He referred to the success of the work done at Barrasford, Northumberland, and to the fact that the Newcastle-upon-Tyne Corporation had agreed to take twenty beds at the rate of £100 per annum: he considered it cheaper to contribute £2,000 per annum for twenty beds than to build a municipal sanatorium.

Alderman Thomas also took part in the discussion.

INFANT MORTALITY AND PARLIAMENTARY LEGISLATION.

By Lieut.-Col. ROBERT CALDWELL, F.R.C.S., D.P.H., R.A.M.C.,

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(MEMBER.)

AS, in spite of all that has been done, said, and written, the problem of infant mortality remains one of ever pressing importance, I thought that an effort to forecast the probable effect of certain Parliamentary legislation on the evil in question might be of interest, and afford ground for useful discussion.

I need scarcely say that I am not concerned with the policy of the Government, except in so far as the present question is involved, and I hope to confine my remarks to such issues as bear directly on this branch of sanitary science. With all deference to others, I would venture the opinion that there is a natural tendency among members of the medical profession to limit their attention to the more immediate and apparent causes of infant mortality, such, for instance, as improper feeding and maternal neglect, and to lose sight of the fact that the apparent cause is commonly an offshoot of that growth of sanitary evil of which the roots lie buried, and therefore hidden, deep down in our national existence; but I think that the doctor might, without in the least stepping beyond his legitimate functions, try to ascertain something of the part played by economic conditions in bringing about results with which we are all, to a greater or less extent, familiar.

Among the causes which lie nearest to the roots of the mischief, and which are, therefore, among the most comprehensive, food and the dwelling are pre-eminently likely to command attention, and it is towards the alleviation of these causes that the Parliamentary legislation, to which I propose to invite your attention, is largely directed. By way of bringing the discussion within reasonable limits, I propose to limit the term food to

milk only, and to omit any discussion regarding those proprietary articles which flood the market, and the alleged results of which are pictorially displayed throughout the country.

It is a matter of common knowledge that milk farms in general are far removed from that standard of cleanliness which public health demands. Doubtless some defects are easily removable: for instance, it should be criminal to employ as milkers persons who act as though cleanliness were an absurd and vexatious superfluity, and who consider it necessary to spit in their hands as a preliminary to milking. Other defects present greater difficulty; these are generally of a structural nature and cannot be remedied without expense, and herein lies the crux of the question. A formidable barrier to improvement has been found in the fact that farmers being in great measure yearly tenants, and being in consequence practically dependent on the goodwill of the landlord, and having in the past no regular claim to compensation for improvements, the risk of pecuniary loss without corresponding profit would not be readily incurred.

The pecuniary disadvantage at which the yearly tenant is placed seems too plain to need detailed discussion, yet, strange to say, it has not attracted the attention from sanitarians which its importance demands, and this absence of attention is a most regrettable fact, it being quite fair to assume that insecurity of tenure must induce a desire, possibly blameworthy, but none the less natural, to secure, while the opportunity lasts, as large a profit as possible, by producing milk under the cheapest conditions obtainable, and regardless of the possible consequences to the health of consumers.

Much has been written and much has been said about the conditions of the ideal dairy farm, and yet the stubborn fact remains that the eloquence poured forth at hundreds of meetings of learned societies has never yet fired the tenant farmer with an ambition to risk the pecuniary ruin of himself and his family in the interests of public health, and incidentally in those of his landlord, to whom, of course, improvements would ultimately revert.

Let us now try and form some idea of the effect that recent enactments may reasonably be expected to exercise on the difficulties I have named.

The enactments to which I refer are, first, Lord Carrington's Agricultural Holdings Act of 1906, and, secondly, the Small Holdings and Allotments Act, which was recently passed into law. It is impossible to enter into details, but, briefly stated, the object of the first of these

measures is to insure to the tenant compensation for repairs to farm buildings, and for losses incurred through disturbance without just and sufficient cause; and the second effects security of tenure as long as rent is paid and certain reasonable conditions complied with. The effect of those measures cannot be foretold, but in the meantime it clearly comes within our province to watch for results, as it needs no great effort of reasoning to see that granted compensation for improvements, and security of tenure, local authorities can enforce sanitary regulations which, up to the present, have been largely a dead letter, and we can therefore entertain a reasonable hope that Dairy and Milkshops Orders may ultimately be worth considerably more than the paper on which they were drafted. I cannot refrain from observing that if the owner of the land was legally compelled to bear a due share of responsibility, the weight of which rests on the tenant, the reformer's dream in the shape of model dairy farms, with resulting benefit in the shape of a diminution in infant mortality, might have been realised long ago.

I am now going to make what may be considered a very heterodox assertion, and one, moreover, which appears to be a direct contradiction of a good deal that I have already said. To put the matter in as few words as possible, I very much question whether, in spite of its far reaching nature, the influence assigned to a pure source for milk has not been greatly exaggerated as regards high rates of infant mortality. One farm may, and commonly does, supply several shops, or, in the case of large concerns, many farms may supply one central depot. Each shop or depot supplies many customers, so that the persons who obtain milk from the same source may occupy almost every rung of the social ladder. If the source approximately affects all alike, how are we to account for certain remarkable differences in the incidence of infant mortality. For instance, the Parliamentary Secretary to the Local Government Board recently stated in public that in 1904 the infant mortality in St. Mary's, Birmingham, was 331 per 1,000 births, while at Bournville, quite close, it was 65 per 1,000 births. Prof. Glaister of Glasgow has pointed out that in 1901 the average infant mortality for Lancashire, Northumberland and Durham, all colliery and manufacturing districts, was 197 per 1,000 males born, and 163 for females, while Rutland, Wilts and Dorset, all agricultural counties, the average mortality for the same year was 102 per 1,000 for males and 88 for females; he also stated that in Scotland in 1900 in the principal town districts the rate for both sexes was 146·9 per 1,000, in mainland rural districts it was 94·5 per 1,000, and in insular rural districts it was 75 per 1,000. The report for 1906 of the Medical Officer of the

London County Council reveals an infant death-rate of 94 per 1,000 in Hampstead and 167 per 1,000 in Stepney.

Major R. J. Blackham, R.A.M C., in a paper which he recently read before the Institute,* showed that for the decennium 1897 to 1906 the average infant mortality among the married families of H.M. Troops at Devonport was 43·09 per 1,000 births as contrasted with 134·6 per 1,000 in the civil population of the same town; and there is every reason to believe that the milk was largely obtained by both classes from identical sources. Dr. Routley, M.O.H., Aldershot, has set forth some highly interesting figures pointing in the same direction as the above; these figures are as follows: during the quinquennium, 1902–1906, there were 62 deaths from diarrhœal diseases among infants in the town of Aldershot, and 17 from the same cause in the camp. The births in the two districts during this period were in the proportion of 4 to 3, viz.: 2,800 in the town, and 2,092 in the camp. Dr. Routley also stated that the original source of milk supply was common to both districts; "the milk vendors in the town supplying both districts in their entirety."

I will not weary you further by piling up figures, let it suffice to say that differences in recorded rates of infant mortality are sufficiently striking to excite our interest regarding influences, besides those of food, which are certainly at work. I do not wish to be misunderstood; I have no intention to minimise the importance of a pure milk supply, but I am anxious to assign its approximate value to each factor in the problem which we are now trying to solve.

Doubtless the causes which bring out the difference to which reference has just been made are sufficiently numerous, and so far interdependent as to render it impossible to completely disentangle one from the other, but among all these causes, whatever they may be, a position of supreme importance is occupied by the dwelling, including, of course, all the subsidiary factors comprised therein, such as drink, vice, filth and the greater part of that catalogue of abominations which seem to be naturally associated with the submerged population of our great cities.

How will such conditions be affected by Parliamentary legislation? I think that possibly I may save time and illustrate my meaning by an example. In a large manufacturing town, where I was recently stationed, which possesses the unenviable notoriety of an appalling rate of infant mortality, and where the homes of the artizan class, taken as a whole, are an excellent representation of the most sickening forms of

* "Infant Mortality," Vol. XXVIII., p. 269.

bestial squalor which it is possible for the human mind to conceive, the ground rents are drawn by two of the wealthiest landowners in the United Kingdom. As leases have fallen in, it has been found that the land has progressively increased in value, this value being naturally due to the enterprise of capitalists and to the skill and industry of labourers, and it represents at present a colossal fortune: yet every farthing of this increase passes into the pockets of private individuals and not one farthing is retained by those who made it. Putting aside the fantastic doctrines which emanate from the distorted intellects of Socialist agitators, we may reasonably ask ourselves the question whether it is consistent with the interests of national well being that some part of the wealth to which I have referred should not be retained for the physical betterment of those to whose exertions it is due, and it is with the object of effecting such retention (judging by the public utterances of responsible persons) that the Land Valuation Bills for England and Scotland have been framed. Omitting details, the general principle of the Bills is to ascertain the true value of the land and to make such valuation a basis for future taxation: the results being applied to housing and other reforms, as to the necessity for which all parties are agreed. To effect these reforms money is necessary, and as it seems unlikely that much more can be extracted in the way of rates from the poor, and from men of moderate incomes, it is proposed to place the burden on the shoulders of the owner of the land as well as on those of the occupier. As we are fortunately not assembled for political purposes, we need not in the least concern ourselves as to whether His Majesty's Ministers are or are not deserving of those flowers of speech so liberally bestrewn on them, but one fact remains unassailable, that the measures in question afford a reasonably hopeful prospect of dealing satisfactorily with those social conditions of which infant mortality forms an integral part.

It would be a matter of deep regret to me if I were to utter one disrespectful word concerning the work of ministers of religion, health visitors, and genuine philanthropists, but I cannot but feel that efforts in the direction of advice are in a great measure useless in the case of the inhabitants of such slums as are found in the north of England, and in fact in our large centres of population generally. Lady visitors unquestionably do splendid work, but it appears likely that it is mainly limited to those who are sufficiently hopeful to appreciate advice, and sufficiently well provided with worldly goods to be able to act on it. What is the use of advice to a family occupying a room which serves as sitting room, sleeping room, kitchen, larder, nursery, and maternity ward, with possibly

a filthy privy hidden in the back yard; and what is the use of preaching decency and self respect, both factors in the problem, when the sexes are huddled together with a promiscuosity which might shock the instinctive modesty of a primeval savage; and what is the use of pointing out the evils of the public-house when, as I heard recently stated, the public-house is more sanitary than the home? Advice under such circumstances is not only useless, it is an insult. We all, probably, know the story in "Oliver Twist" of the starving pauper who was relieved with a half-pint of oatmeal and a pound of potatoes. "Great heart," said the ungrateful ruffian, "what's the use of this to me, you might as well give me a pair of green spectacles."

Whether you agree with me or not as to the probable effect of land valuation, and subsequent taxation of ground rents, on infant mortality, I think you will find that the measure in question is worthy of your careful attention, and to philanthropists in particular it offers exceptional interest. To two points in particular I invite your attention, one is that infant mortality and overcrowding go hand in hand, and the other is that high ground rents are a direct incentive to the owner of slum property to cram the highest possible number of what I would call paying units into the smallest possible space. It is likewise most important to observe that as all buildings revert to the ground landlord on the conclusion of the lease, a direct premium exists on the worst forms of jerry building.

I fear that in venturing to discuss a subject that has unfortunately, but, I presume, unavoidably, been thrown into the cock-pit of party politics, I have trodden on delicate or even dangerous ground; but on the other hand I feel confident that men whose calling is essentially one of facts, not fancies, are eminently qualified to judge dispassionately of measures which, in their influence on the physical well being of the people, are intimately associated with the honour and integrity of our Empire.

THE RELATION OF PROTOZOA TO PREVENTABLE DISEASE.

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(MEMBER.)

IN the whole range of modern scientific medicine there is no subject of deeper interest to the physician than the relation of the parasitic protozoa to disease, but the complexity of the subject, and the rapidity with which important results have been published by observers of established reputation, render the presentation of an adequate and up-to-date summary of even a small portion of the accepted facts of recent medical protozoology a task of considerable difficulty.

Firstly, it is essential to briefly define what we mean by protozoa.

In the words of Sir Ray Lankester, "the protozoon individual is a single corpuscle of protoplasm varying in size when adult from less than one-thousandth part of an inch in diameter (some sporozoa and flagellata) up to the diameter of an inch (nummulites), and even much larger size in the plasmodia of mycetozoa."

The term protozoa originated as a translation of the German word *Urthiere*, and the members of the group are definitely distinguished from all the rest of the animal kingdom, being "essentially unicellular animals."

Minchin points out that growth and reproduction by fission may in these little creatures continue for many generations, but sooner or later their true animal character is demonstrated by the introduction of a process of sexual union into their life-cycle. The biological import of this process is not clear, but in some cases it is certain that it frequently produces a rejuvenescence of organisms which have become effete and feeble by a prolonged vegetative existence.

The sexual process may intervene at any period of the life-cycle, and may either precede or follow rapid *reproduction by fission*: and conjugation, though generally associated with reproduction, may occur independently of it. True conjugation in protozoa consists of the fusion of the nuclear substance from two individuals.[15]

[15] A list of references is given on page 408.

The individuals who go through this process are called *gametes*, and if the union extends to the fusion of the whole bodies of the organism the resulting individual is called a *zygote*.

The gametes may be similar in all respects, or may be differentiated into *microgametes*, regarded as males, which are smaller and more motile, and *macrogametes*, regarded as females, which are more bulky, often full of reserve material, and less, or not at all, motile.[15]

In some cases not only are the conjugating individuals different from one another, but the individuals of the generation from which the gametes arise may be different from ordinary individuals of the same species.

The mother-cells of the gametes are then distinguished as gametocytes, and styled macrogametocytes or microgametocytes according to the variety of gamete to which they are the precursor.

I must beg you to remember these terms if they are not already familiar to you, as they recur in describing the development of different families of the organisms.

Ray Lankester[20] gives an elaborate classification of protozoa, but the arrangement best suited to the purpose of this paper is that of Butschli, who divides them into the following four classes, arranged in the ascending scale of animal development:—

1. Sarcodinia (or Rhizopodia), comprising those forms having the general characteristics of Amœbæ;

2. Mastigophora or Flagellata, *i.e.*, forms having a new flagella;

3. Infusoria or cilitia, being those organisms having an elaborate arrangement of cilia or flagella;

4. Sporozoa, viz., those forms of protozoa which are rarely amœboid and multiply by a form of sporulation.[29]

As it is obviously impossible, in the space at my disposal, to consider, however briefly, *all* the protozoa concerned in the production of disease, I propose to confine my remarks to six diseases of special interest to the medical officer of health: (1) amœbic dysentery; (2) trypanosomiasis; (3) syphilis; (4) kala azar; (5) malaria; (6) piroplasmosis.

It may be objected by some that these diseases with one exception are maladies peculiar to tropical countries, and that they are therefore of comparatively small interest to practitioners in this country.

I would meet this objection by pointing out that "so widespread is our empire, so intimately connected are we with countries of different, and for the most part warmer, climates than our own, that there is scarcely a family in these islands that has not some relative who occasionally returns to his native place from abroad. In many instances the tropical resident

is sent home on sick leave or to recoup after a long spell in a trying climate. He may be suffering from actual illness on landing, but it is not uncommon for a tropical resident whilst at home to develop some latent illness, such as malaria, liver ailments, or dysentery."[4]

It comes about, therefore, that medical men in the most remote corner of Dartmoor, or some obscure village on the rocky coast of Cornwall may find themselves face to face with tropical ailments with whose very name they may be unfamiliar.[4]

A short account of some of the more common protozoal diseases may therefore be not only interesting, but useful to medical men, especially those in practice in one of the most important ports of Great Britain.

The first disease to claim our attention is dysentery, a condition which recent research has taught us is not one malady, but at least two distinct diseases. One variety due to bacilli of very varying characters, and, therefore, of no present interest to us, and another caused by a protozoon and called—

Amœbic Dysentery.

The organism which induces amœbic dysentery belongs to the rhizopodia or lowest class of protozoon, and proceeding on zoological lines from the lowest form of development to the highest, it comes first on our list of diseases.

In examining the fauna of the intestine of man it must first be clearly understood that a great variety of amœboid organisms flourish in this human jungle, some of which are true amœbæ, whereas others are merely amœboid stages in the development of various *Infusoria*, such as *Trichomonas* and *Lamblia*, hereafter referred to.

True amœbæ are divided into two groups: (*a*) thecamœbæ, or those provided with a hard envelope or shell; and (*b*) gymnamœbæ, or those consisting merely of homogeneous protoplasm. The members of the first group are not concerned in disease, but two individuals of the second group are of great interest to the physician.

One of these, the Amœba coli, which has been renamed by Schaudinn the *Entamœba coli*, is a harmless parasite, whereas the second, which he styles the *Entamœba histolytica*, is one of the most lethal of pathogenic protozoa.

The life-history of these simple forms of animal life is very complicated, and we owe our present knowledge of its intricate details to the industry and genius of Schaudinn, whose untimely death all interested in the subject of protozoology must deplore.

Schaudinn's work has been carefully studied by McWeeney, who has

conferred a boon on all interested in the subject by summarising the abstruse scientific German of Schaudinn's articles in a brilliant paper read before the Epidemiological Society in January, 1905.[17]

Schaudinn describes the Entamœba as a shapeless mass of protoplasm, with a large nucleus, but not showing any of the differentiation into clear ecto- and granular endoplasm which marks the pathogenic form.

He found the parasite in the excreta of about half the persons which he examined, and Schuberg afterwards demonstrated the fact that as the organism dwells in the upper regions of the colon, by hurrying the onward passage of the fæces the protozoon could nearly always be found in the dejecta of healthy individuals.

The *Entamœba* has two well-marked methods of reproduction, one merely vegetative and the other clearly sexual in type.

The asexual form consists in simple segmentation of the nucleus into eight parts, which surround themselves with protoplasm and separate into "a characteristic brood" of young amœbæ.

In the sexual cycle of reproduction the organism comes to rest, contracts, and "surrounds itself with a gelatinous coat which becomes the cyst wall."[17]

The nuclei, after undergoing reconstruction, divide, copulate, and then divide again, so that the parent nuclei eventually form eight young amœbæ which are enclosed within the cyst-wall, and like the cysticercus of the tape-worm cannot start in life on their own account until the cyst has been taken into the stomach of a new host and the gelatinous cyst-wall dissolved by the intestinal juices.

The *Entamœba histolytica*, as the *Amœba dysenteriæ* is called by Schaudinn, differs widely in appearance and mode of production from the non-pathogenic type of organism.

It has a clear tough ectoplasm and an ill-defined nucleus, and Schaudinn considers that this tough outer layer enables the parasite to force its way between the epithelial cells of the intestinal mucous membrane into the deeper layers and submucosa, where it undergoes development, destroys the tissue, and thus forms the ulcers characteristic of dysentery.

In support of this view he states that he has actually observed the protozoa forcing their way between the cells in the freshly-excised bowel of a cat which had died of amœbic dysentery.

Entamœba histolytica in its asexual form multiplies by simple fission or forms new amœbæ by budding; "the characteristic brood formation" of the non-pathogenic organism does not occur.[17]

The cystic stage is also produced in a different way, and it is of special

interest to note that it is not formed till the patient is beginning to recover from his attack and the stools are becoming solid, a fact which is of the utmost importance in framing preventive measures against the disease.

The protozoon throws out from its surface a series of little knobs, about three microns in diameter, each containing a particle of chromatin. These knobs break off and, having developed a firm capsule, ultimately become hard, opaque little bodies called, for want of a better name, "spores."

These bodies are expelled in the fæces, and on being taken into the intestinal tract infect a new host.

An experiment of Schaudinn's seems to prove this conclusively. He allowed some of the fæces from a case of undoubted tropical dysentery to dry in air, and assured himself by careful microscopy that it contained nothing resembling the cysts of *Entamœba coli*, but only the "spores" of *Entamœba histolytica*.

He took the material from the slides actually examined, and having made it into an emulsion with water gave it in food to a healthy young cat, whose fæces had been proved to be free from dysentery organisms. In three days the cat passed stools containing typical *Entamœba histolytica*, and it died of dysentery on the fourth day.

The autopsy showed typical dysenteric ulceration of the colon with entamœbæ "in all stages of penetration of the intestinal wall."

Schaudinn gave large quantities of fæcal matter from this case to another cat but the animal remained healthy, showing that the amœboid form of the organism is innocuous.

He then administered a little of the dried-up fæces containing some of the spore-like bodies from the tropical dysentery case, and the animal, which was larger and stronger than the first cat, developed dysentery in due course and died in a fortnight.

It is, therefore, to the spores of *Entamœba histolytica* contained in dust and water that we must look for the cause of the propagation of amœbic dysentery, and this discovery of Schaudinn's is of enormous practical value to the physician, as it emphasises the necessity for complete segregation of the sick *and convalescent* from the healthy, and the adoption of every possible precaution to prevent the contamination of water and food by these long-lived and lethal cysts of the protozoon of dysentery.

Before leaving the subject of dysentery I would especially ask you to never make a diagnosis of dysentery from the mere macroscopic appearance of the stools.

In an article on tropical dysentery published in the *Lancet* two years ago I said that "the stools of all patients suffering from intestinal flux should be subjected to a microscopical examination," and declared that my chief object in writing the paper was to call attention to the fact that the character of the stools alone is not to be considered as a test of the absence, or presence of dysentery.

This view has been supported by Cantlie who writes: "Because a patient has resided in the tropics, one is apt to forget that there are other causes of loose motions, and mucus in the fæces with, or without, blood."

"Of these the more common are intestinal parasites, which are so frequently met with in the fæces of tropical residents that medical men in Britain would do well to submit the stools of all cases of patients coming under their care who present symptoms of intestinal flux, to a pathologist."[4]

In women the pelvic organs ought to be examined in all cases of intestinal flux. Cantlie says he "'cured' instantly several cases of so-called chronic dysentery and sprue, and the passing of intestinal mucous casts by replacing a retroverted or retroflected uterus and inserting a ring-support. In other cases left pelvic adhesions of the uterus and left ovarian trouble (from the fact that they involve the rectum or sigmoid flexure) set up intestinal troubles, which when the cause is removed the so-called dysentery or chronic diarrhœa disappears."

"What is called chronic dysentery, but in reality is simple diarrhœa, is a common feature of hepatic disease in patients returned from the tropics. All too frequently the simple morning diarrhœa of the tropics is due to hepatic derangements set up by alcohol, a fact that is apt to be overlooked because the patient is home from the tropics, and the ailment is looked upon as "climatic" when the cause is frequently whisky."[4]

In long-standing cases of this nature the condition of the liver will help in the diagnosis, and if, in addition to morning diarrhœa and hepatic atrophy or hyperplasia, there is albumen in the urine, associated with hepatic tenderness on palpation, the part played by alcohol should not be difficult to arrive at.[4]

Tropical dysentery as met with in Britain is, I consider, invariably of the amœbic type, and, as I have pointed out elsewhere, I regard ipecacuanha as a specific in its treatment.

As a point of practical interest in the laboratory I may remind you that amœbæ can only be found in the stools within twelve hours after being passed, as after that interval they begin to break up. They are

found most readily in the smaller pieces of mucus. The organisms disintegrate with heat so the films cannot be fixed in the Bunsen flame. They should be dried in air and then placed for five minutes in Gulland's fixing solution, which is made up as follows:—

Absolute alcohol	25 cc.
Pure ether	25 cc.
Solution of corrosive sublimate in Alcohol (strength 2 grammes in 10 cc.)	5 cc.

The films should then be immersed in carbol fuchsin for three minutes, washed vigorously in water for thirty seconds, and dried in air.[8]

Trypanosomiasis.

The next class of protozoa on the upward scale is the Mastigophora containing the sub-class Flagellata, which includes the great family of Trypanosomata, a group of organisms which has claimed the undivided attention of many observers in various parts of the globe for the past five or six years.

This variety of parasite has been known since 1876, when Surgeon-Major Lewis described it as a harmless parasite existing in the blood of healthy rats. Since that year different observers have noted the presence of varieties of the organism in different animals, but the present access of interest in Trypanosomata dates from 1901, when Dutton recognised as a member of this group the "vermicule" which Ford had discovered in the blood of an European at Bathurst.

Dutton named the organism the *Trypanosoma gambiense*, and Castellani[9] showed in 1903 that this protozoon was present in the cerebro-spinal fluid of patients suffering from sleeping sickness, a discovery which led the way for the investigations of Bruce, Greig, Nabarro, and Todd, and our present exact knowledge that sleeping sickness is merely a *late* manifestation of human trypanosomiasis.[1]

This malady has a sorrowful interest for members of the R.A.M.C., as the first recorded case in a British officer was Lieut. Forbes Tulloch, who succumbed to his zeal in the interests of protozoology only a year or so ago.

The trypanosome of all varieties is a somewhat fish-like structure with a fin-like projection on one side called a flagellum. In the body are two basic-staining granules and two chromatin masses, one in the middle called the macronucleus, and the other in the tail or posterior called the micronucleus.

The pathogenetic properties of the organism depend on their power of adapting themselves to various hosts when transferred to individuals of a new species, from animals in which they naturally occur, by a variety of biting flies. They flourish exceedingly in their new hosts, and thus work their destruction, *e.g.*, the Nagana trypanosome multiplies so exceedingly in the blood of a rat inoculated with the protozoon that just before death there are almost as many trypanosomes as red corpuscles in the blood.[15]

The features of development common to all forms of trypanosomata are somewhat as follows:—

The individual organisms are differentiated into male, female, and indifferent forms. All three varieties may multiply by splitting longitudinally, a process which takes place in the following way: (1) the macronucleus becomes dumb-bell shaped and splits in two; (2) the micronucleus behaves in a similar way; (3) a second flagellum is produced: (4) fission begins at the tail-end; but (5) actual separation commences at the head and goes on till two fully formed trypanosomes are produced.

This process may fall into abeyance when sexual forms become fully developed. The three types may be observed in the vertebrate host, but are usually not clearly differentiated except in the invertebrate host.

The males are much more slender than the females, and are so delicate in constitution that they soon die off if they do not conjugate.

The indifferent types are hardier than the males, but the females are the most resistant of the three, as they have a quantity of reserve material stored up in their interior.

The male and female forms undergo a process of maturation in the gut of the biting fly, which acts as intermediate host, and it is in this position that the act of union can alone take place.

The sexual forms undergo complete fusion in the process of conjugation, and the resulting zygote is an individual similar to the oökinet, or vermicule stage of the malarial parasite. This stage, however, gradually develops an undulating membrane and flagellum, and becomes an ordinary trypanosome which takes on a vegetative cycle of existence.

Under adverse circumstances the female trypanosome can undergo a species of self-fertilization and repopulate its vertebrate host; its descendants being gradually differentiated into male and female.[15]

Such, very briefly is the ordinary life-cycle of these curious little animals, but of course many modifications exist, and certain phases and forms of trypanosomata cannot be attributed to these comparatively simple data.

Closely allied to the trypanosomata is the group of organisms known

as spirochætæ, which were long confused with the class of bacteria called spirilla.

Schaudinn has, however, traced the development of the organism through somewhat similar stages to those which are shortly to be described in the protozoon of malaria until male and female individuals capable of exercising sexual functions are formed. This brilliant and industrious observer worked out the development of the spirochæta in a plasmodial parasite of the barn-door owl.[22]

He considered that owl-malaria was propagated by a mosquito called the *Culex pipiens*, and found that as a result of fertilization an oökinet, or locomotive zygote is formed, which becomes converted into male, female, and indifferent trypanosome-like bodies in the front of the mosquito's stomach. The process of development is extremely interesting, but space compels us to proceed at once to follow the organism into the blood of the owl, whither it is conveyed by the bite of the mosquito in the same manner as the sporozoite of malaria.

On entering the blood the spirochætæ adhere by their flagella to the red cells, bore their way into them, and there develop into a plasmodial form. They do not proceed to form rosettes or crescents as in human malaria, but at first simply reside in the cells of the spleen and bone marrow as a snail lives in its shell. They leave their host cells at night and swim about freely in the blood, but re-enter the corpuscles in the daytime. They reach their full stage of development in about six days, and begin to multiply by longitudinal fission. The minute trypanosome-like bodies so formed proceed to attack fresh cells until the blood becomes inundated with parasites.

At this stage the protozoa gradually die down until only a small number of indifferent forms survive, which become gradually converted into micro and macrogametocytes, which can only complete their development in the body of the *Culex pipiens*.

This observation, for a time, raised the question whether all spirochætæ or spirilla might not be merely features in the development of trypanosomata, and McWeeney stated that "should Schaudinn's work be confirmed by other observers then it follows that trypanosomata and spirochætæ are really different names for the same thing."[17]

Syphilis.

This disease has peculiar interest for the protozoologist, as on April 10th, 1905, appeared a paper by Schaudinn, in which he published an account of his discovery in various syphilitic affections of a small

actively motile spirochæte which he looked on as the probable cause of syphilis.

This organism he, at first, named the *Spirochæta pallida*, but as this title was not distinctive of the zoological class he altered it to *Treponema pallidum*. In October, 1905, he announced that his discovery had been confirmed by more than one hundred independent authorities, and since that date it has come to be a generally accepted fact that syphilis is a chronic disease due to *Treponema pallidum*.

This spirochæte is only one of many similar organisms found in various pathological conditions, but it has the following well-marked characteristics which serve to distinguish it:—(1) It generally measures about seven microns in length and consists of several slender spirals which have a peculiar rigid appearance suggesting that the organism has been "turned on a lathe." (2) Its coils are more numerous than those of other spirochætæ. (3) It never stains deeply. (4) By Giemsa's stain, which is a modification of Leishman's in which azure is used instead of methylene-blue, it is coloured a delicate red, whereas other spirochætæ take on a bluish colour. (5) It has sharp tapering extremities, whereas the "pseudo-pallida," which is found in ulcerating carcinoma for example, has blunt rounded extremities.

Schaudinn looked upon spirochætæ as modified trypanosomes, and, in his work on Zieman's parasite, describes an oökinet which becomes coiled up and then divides into a large number of small trypanosomes which get spirally twisted round their long axis so as to constitute what have hitherto been known as spirilla. His idea that *all* spirochætæ are probably members of the protozoa class, which quite recently claimed the support of many eminent bacteriologists, must now be abandoned, as Novy and Knapp have shown that the best known member of the group, the *Obermeiri Spirillum*, is a true bacterium.[14]

Two Polish investigators, Krzysztalowicz and Siedlecki, describe forms which are considered to be sexual individuals, and suggest that the zygote passes into a resting stage and become transformed into some sort of spore, which, having been carried to a remote portion of the body, forms new spirochætæ and gives rise to the secondary symptoms of syphilis.[15]

Minchin says: "The transmission of treponema pallidum from one host to another by the contagion of coitus without an intermediate host is analagous to dourine, in which infection occurs in a similar way."[15]

The prevention of disease caused by this interesting protozoon is a subject of the widest importance to all sections of the community. It is

the fashion to pretend that syphilis is a malady chiefly of interest to the military surgeon, but everyone with any considerable experience of out-patient work in a large hospital knows that the malady is probably as common amongst the civilian as the military population.

There is this difference: that, nowadays, the soldier rarely, if ever, conceals his disease, and has the advantage of a year or two of compulsory medical treatment and supervision on the very latest scientific principles, whereas only too frequently the civilian is ashamed to consult a reputable practitioner, and falls into the hands of quacks and charlatans with the most disastrous effects.

This being so, the work of Roux and Metchnikoff on the prevention of syphilis is of the highest importance. These distinguished investigators have been working for some years to discover an antisyphilitic serum, but their prolonged investigations have as yet resulted in failure.

They have, however, reported to the French Academy of Medicine that an ointment consisting of one part of calomel to two parts of lanoline has proved to be an absolute prophylactic if rubbed into the genitalia within twenty hours after exposure to infection.

In support of their contention they give details of many experiments, not only on monkeys, but also on a young medical student, who, in the interests of humanity, permitted himself to be inoculated with syphilis.

This discovery is, I think, one of the highest value, and one which cannot be too widely known, both in and out of the profession, as the sanitarian aims at preventing disease, and must consider all legitimate means justifiable in attaining his laudable end.

Closely related to the spirochætæ is the genus of *Flagellata*, known as *Herpetomonas*. This sub-order is of special interest to us, as zoologists now refer to it as The Leishman-Donovan Bodies.

These peculiar bodies were discovered in 1900 by Leishman, and independently in 1903 by Donovan in smears of spleen pulp from cases of kala azar, and are invariably found in the spleen pulp and bone marrow of patients suffering from kala azar, a peculiar type of fever found in India, China, and tropical Africa.

The Leishman bodies "have been the subject of much controversy as regards both questions of hypothesis and matters of fact."[1]

Even the very situation of their occurrence has been disputed, for whereas Donovan described and figured them in unaltered red blood corpuscles, both in the spleen and general circulation, Christophers found them only in the leucocytes peripheral blood, and doubts the specific

nature of the bodies in the red blood corpuscles, whether in the peripheral circulation or the spleen or blood marrow.

The Leishman bodies are ovoid or pear-shaped, about three microns in the longest and two microns in the shortest diameter. They contain two nuclei or chromatin masses, situated in the short axis of the body.

One of these masses is much larger than the other, more or less spherical in shape and stains faintly, whereas the other is generally rod-shaped and stains very deeply. Sometimes a bridge of protoplasm unites the two nuclei. The parasites multiply by binary or multiple fission.

The reason for including these curious little bodies in this group is the remarkable fact, discovered by Rogers, that they can be grown in citrated blood into distinct flagellate organisms.[14]

No conjugation occurs, however, in the laboratory grown organisms, which simply degenerate and die off without further development.

The artificial development of the organism has been carefully studied, but none of the stages of natural development have as yet been observed.

The agency by which the parasite is disseminated has not yet been clearly ascertained, but Rogers has produced considerable evidence to show that the bed-bug is the invertebrate host.[15]

This brings the prevention of kala azar within the sphere of practical sanitation, as the extensive destruction of body-parasites in affected areas, although presenting many difficulties, is not impossible, and must lead to marked diminution in the spread of the disease.

We now arrive at the third class of protozoa, and find that the *Infusoria* have little interest for us, as, of the known members of the group, *Trichomonas vaginalis* is a harmless parasite frequently found in the vagina, and familiar to medical jurists on account of a superficial resemblance to the spermatazoon, whereas *Trichomonas hominis* and *Lambli intestinalis* are rarely associated with pathological conditions, and only here referred to on account of an amœboid stage in their development which may be confused with true entamœbæ.

Malaria.

Passing to the last class in the zoological arrangement adopted, we find the most interesting organisms yet considered, namely, the parasites concerned in the production and propagation of malaria.

The *Sporoza* are so called because at some time in their life-history the individual sporozoon breaks up into a number of small bodies resembling spores.

The order of the zoological class to which the malarial parasites belong is called the *Hæmosporidia*, because they live in, and at the expense of, the blood-corpuscles.

There are many varieties of organisms found in the blood of various animals, and it is generally accepted that at least three varieties are found in man, although M. Laveran, the discoverer, still maintains that there is but one form of human malaria.

The *Hæmosporidia* found in man are included in the Genus *Plasmodium*, viz.:—(1) The *Plasmodium malariæ*, producing quartan ague; (2) the *Plasmodium vivax*, producing benign tertian; and (3) the *Laverania malariæ Grassi*, the cause of malignant tertian ague. All three have a double cycle of development, one sexual and the other asexual.

The asexual cycle can take place entirely in the blood of man, but the sexual required a change of host-*species* as distinguished from host-*individual*, and cannot occur without the intervention of the mosquito.

The process of development starts from the small spore-like bodies, from which the sporoza class derived its name, finding their way into the blood, fixing themselves on to the red corpuscles and boring their way to the interior of these cells.

In the second stage of development we have, therefore, the plasmodium inside the red blood corpuscles forming the ring shape, with the chromatin at one spot, as shown in Major Morgan's beautiful plates which are given in the *Journal of the Royal Army Medical Corps.**

From the ring shape the parasite may take on the sexual or asexual form. Let us follow the asexual cycle first. We find that the parasite grows at the expense of the corpuscle, absorbs its fluids and rapidly increases in size. It abstracts the hæmoglobin from the stroma of the cell, and alters it into a black or brown pigment called melanin.

In the interior of the corpuscle the parasite is motile and throws out processes which alter in shape, but when it comes to occupy the greater part of its host cell, the chromatin of which it is largely constituted begins to split up into two, four, eight, twelve or more segments.

On the completion of this process of segmentation the protozoon has divided into several fragments of chromatin, each surrounded with protoplasm, and arranged in the form of a daisy or rosette with melanin granules in the centre, forming the stamens of the daisy or centre of the rosette.

The petals of the daisy or loops of the rosette constitute the small

* Vol. VI., No. 1, Jan., 1906, pp. 50 and 52.

bodies originally referred to as spores, and when this curious malarial blossom is full-blown, the remains of the red cell rupture and its baleful contents are set free to attack fresh red blood corpuscles and start the cycle anew.

The melanin passes into the blood stream, and is carried by the leucocytes to the tissues producing the darkening of the skin and organs which is so familiar in subjects of malaria.

The process detailed constitutes an asexual developmental cycle of the parasite, and in quotidian ague takes only twenty-four hours from spore to spore.

If quinine is not given this goes on until "owing to the production of specific anti-bodies," or "the exhaustion of the reproductive power of the parasite under the strain of a repeated asexual division this process gradually ceases, and specially differentiated male and female forms" appear in the following way:—

Starting from the ring shape the sexual cycle proceeds at first in much the same way as in the asexual. Melanin and chromatin are formed, but when the parasite is one-third grown the latter can be seen in a clear unstained zone called the vacuole, which, Leishman teaches, is characteristic of this form of development. Another special point in this form of development is that the chromatin mass shows no tendency to segment.

When the protozoon nearly fills the red cell it is called a gamete or gametocyte, and if the patient is not bitten by a mosquito at this particular period the parasite dies, but if prophyaxis has been lax, and the organism passes into the stomach of a mosquito, its true sexual life begins.

The male gametes are called, as we have seen, microgametocytes, and the female macrogametocytes.

Ten minutes to half an hour after the blood has been sucked in by the mosquito the microgametocyte, which is readily recognized by its hyaline plasma, large nucleus, and coarsely granular pigment, exflagelates four to eight filaments about twenty microns long and one micron thick.

These flagella are actively motile and are soon set free, being given the name of microgamete when in the free state. Meanwhile the macrogamete has been preparing itself for fertilization by ejecting part of its nucleus, and McWeeney thinks that this extruded matter may act chemeotactically in attracting the microgametes.

On the approach of the male the macrogamete protrudes a "receptive eminence" or microphyle, and as soon as a male adheres to this the eminence is at once withdrawn, dragging the struggling microgamete into the body of the female. This completes the act of copulation, and the

macrogamete now secretes a coat of mucus which keeps away all other males, its name changes, according to the nomenclature of Schaudinn and Lühe, to zygote or fertilized macrogamete.

The zygote changes rapidly into an oökinet, or motile body, which reaches the wall of the mosquito's stomach, worms its way through the epithelium, and comes to rest between the layers of the muscular wall of the stomach.

In this situation it is called an oöcyst, and having originally been only 7·5 microns (*i.e.*, the diameter of a red blood corpuscle) it hextuples its size and becomes 50 microns, so that it can be seen with an ordinary lens.

A tough resistant membrane develops round the oöcyst which soon begins to segment like a yelk into a mulberry-shaped mass. This mass finally splits up into a number of secondary cysts, or sporoblasts, which are full of elongated thread-like bodies, each containing chromatin, called sporozoites. The sporoblasts eventually burst, and the sporozoites are accordingly set free in the general blood-stream of the mosquito. They are carried everywhere including the neighbourhood of the salivary glands from whence they enter the salivary cells and ducts, so that when a mosquito bites an animal he injects, with the venom which he always instils, several of these fully developed sporozoites which proceed to attack the red blood corpuscles and start the malarial cycle.

Some of the sporozoites are said by Schaudinn to enter the ovary of the mosquito and there infect the ova, so that the young brood of next spring harbours the parasite, and these young mosquitoes can confer malaria without having sucked the blood of an infected individual, a condition of things which, if confirmed by other observers, will explain many epidemiological problems which have puzzled medical officers of health in every part of the tropics.

This sketch of the life history of the malarial parasite is true of all varieties, but I have given in the attached table the special characteristics of each parasite, and will here merely summarize the points in structure common to all three.

1. All live in and at the expense of the red cells. 2. All are amœboid, *i.e.*, are endowed with movement said to be due to (*a*) melanin bodies moving round and (*b*) pseudopodia being formed. 3. All manufacture melanin. 4. Nearly all produce various degenerate changes in the red blood corpuscles. 5. In the fresh state all are colourless, but when dead the protoplasm stains blue and the chromatin red by Romanowsky's method of staining, or Leishman's modification. 6. Each variety has a definite period of growth, 72 hours in Quartan, 48 in Tertian, etc. 7. All possess

sexual and asexual forms, *i.e.*, are capable of forming gametes and rosettes or daisies. (Leishman).

The complex and elaborate details of our knowledge of the connection of the hæmosporidia with malaria we owe to the labours of Laveran,[13] who discovered the organisms; Golgi, who classified them zoologically; Ross[21] and Manson,[16] who ascertained the alternative host; McCallum, who recognised the sexual method of development; Grassi,[9] who identified the variety of mosquito; and last, but not least, the illustrious Schaudinn, who observed the entrance of the sporozoite into his own red blood corpuscles, and thus completed the developmental cycle.

Piroplasmosis.

In view of the fact that Koch,[12] in a recent address, says "our knowledge of protozoal diseases is based on three great discoveries: that of the malarial parasite by Laveran; of the P. bigminium, the cause of Texas fever or red water in cattle, by Smith; and the discovery of trypanosome in tsetse-fly disease," it is necessary to say a few words about tick-fever, especially as Bowhill has found both trypanosome and spirochæte forms in the blood of oxen and dogs affected with this malady.

Briefly stated, there is a group of parasites conveyed by ticks which produce a condition called piroplasmosis, which is found in man, oxen, horses, dogs, etc. These parasites are pear-shaped bodies which are found in the red cells, and affect the infected animal with all the symptoms of progressive hæmolysis, viz., asthenia, anorexia, debility, jaundice, etc., ending in death. They constitute a special genus in the same order and class as the malarial parasite.

The ticks which convey the disease lay millions of eggs, which are hatched out on the ground into larvæ, which crawl "to a summit of a blade of grass or grass-stem, and there await the passage of some animal," to which they cling.

They live on this animal for a few days and then fall off, developing on the ground, first into nympha and later (with or without the intervention of a second host) into full-grown insects of both sexes, which get on the body of an animal and mate. The female then falls off and lays eggs, which in due course develop into larvæ and start the cycle anew.

The tick may convey disease in any of its stages of development, and some varieties lay eggs which produce larvæ which are infective.[21] (See Dr. Theiler's excellent plate, *Journal of the Royal Army Medical Corps.**)

* Vol. III., No. 5, Nov. 4, 1904, p. 476.

This discovery of propagation of disease by body-insects is of the greatest interest to the physician, as it serves to explain obscure epidemics of relapsing and other fevers, which have frequently been carried from point to point in a, hitherto, quite inexplicable way.

The ticks, it must be remembered, are very hardy, and in the intermediate stages can resist starvation for very long periods; so that a larva, nympha, or adult tick may remain perched at the end of a blade of grass or other structure for some months thoroughly capable of infecting a suitable animal.

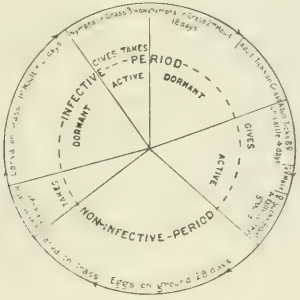

Diagram showing Life Cycle of Tick with three Hosts.

(From Col. Sir David Bruce's Plate, Journal of the R.A.M.C., Vol. VII., p. 23.)

Rhipicephalus appendiculatus is the type of this variety. Other ticks, such as *Rhipicephalus evertsi*, only require two hosts. The nympha develop in the latter variety into full-grown insects, on the grass, in twenty-four days.

The blood of an affected animal does not give rise to Piroplasmosis when directly transferred under the skin of a healthy one. It is only after it has passed through the body of a tick that the piroplasma can give rise to disease.

With these remarks I must bring to a close my necessarily brief account of the association of protozoa with a few diseases of special importance in Preventive Medicine, in the hope that I have at least been

able to bring out the supreme importance of the subject, not merely to specialists, but to every medical officer of health.

The splendid discoveries of Bruce and Leishman of my own corps should interest every earnest physician in blood-diseases and blood-parasites, for in this direction appear to lie discoveries yet undreamed of, as protozoology seems to begin where bacteriology leaves off, and experts consider it more than probable that the long-looked-for *causa causans* of smallpox and yellow fever will be found in the protozoal class of the animal kingdom. In the words of Cantlie,

> "During the last quarter of the nineteenth century bacteriology usurped the attention of medical observers, but with the advent of the twentieth century the protozoologists would appear to be about to oust the bacteriologists from the foremost place in our search after the origin and the epidemiology of disease."

I think it is clear that some knowledge of the development of the organisms referred to in this paper is desirable in every Medical Officer of Health, as without such knowledge he cannot intelligently adopt methods of prevention, which, rather than mere means of cure, is the aim of those on whom the responsibility for the health of the nation depends, not only in this country but in "that Greater Britain beyond the seas."

CHARACTERISTICS OF THE THREE MALARIAL PARASITES AFFECTING MAN.

To accompany "Protozoa and Disease," by Major ROBERT J. BLACKHAM, R.A.M.C.

Name of Parasite and Type of Fever it produces.	Effect on the Red Blood Corpuscles.	Character of Melanin produced.	Number of Segments in "Daisy" or Rosette.	Degenerative or other Special Changes produced in Red Cell.	Special Characters of Ring Shape.	Effect of Quinine.	Effect of Parasite on the Spleen.
Plasmodium Vivax produces Benign Tertian Fever.	The corpuscles are enlarged to two or three times their normal size, and paler.	Coarse light brown granules.	15 to 25.	A number of red staining spots called Shüffner's dots can be demonstrated with Leishman's stain. They increase only in size and not in number.	Ring larger than in Malignant Tertian.	Quinine, *per oram* or hypodermically, destroys the parasite and cures the fever.	Enlargement is common but not invariable
Plasmodium Malariæ produces Quartan Fever.	The corpuscles are diminished in size, and do not become paler. The parasite fills the whole cell.	The granules are coarser and darker in colour. It is in this variety you get the true daisy shape.	8 to 12. Number of rosettes in peripheral blood is greater than in B. Tertian.	No degenerative changes can be seen, and if your technique is correct this enables you to settle type of fever.	Do.	Do	Do. This was the variety of fever at one time common in England which produced the "Ague cake" of the Fens.
Laverania Malaria Grassi produces Malignant Tertian or Æstivo-Autumnal Fever.	The corpuscles are not enlarged. They do not become paler, but on the contrary some grow darker. The parasite does not fill the cells, which frequently become shrunk and cremated.	"The Melanin is arranged as in Quartan parasite."—Leishman.	There is much difference of opinion, and Leishman teaches that it is best to say "uncertain."	Following out rings which are going to become rosettes, Mara found certain markings which appear to be marks of scars made in stroma of cell by parasite. Increase in number but not in size.	Rings are smaller and more delicate in shape than in other varieties. Present in peripheral blood in larger numbers than in other varieties, and if many rings observed, in blood film, suspect Malignant Tertian.	Very resistant to Quinine.	Splenic enlargement is rare.

NOTE 1.—Malignant Tertian Malaria has been called: (1) Pernicious Malaria, (2) Æstivo-Autumnal Fever, (3) Tropical Malaria, (4) Remittent Malaria, (5) Sub Tertian Fever, Manson. It may be defined as a form of Malaria in which alone the gametes have a crescent form, and might well be called "Crescent Tertian Fever." a synonym now recognised in the official Nomenclature of Diseases. Chromatin is difficult to stain, but exflagellation is easily demonstrated in crescent.

NOTE 2.—The names applied by different authors to the Malarial parasites are confusing. The terminology followed above is that of the Nomenclature of the Royal College of Physicians. The official title of the parasite of Malignant Tertian has not yet been generally adopted. The parasite has been called Plasmodium Immaculatum by Schaudinn, P. Falcipariens by Welch, P. Præcox by Grassi and Felleti, P. Falciparum by Blanchard, and Hæmomenas Præcox by Ross. *Quot auctores tot nomina!*

NOTE 3.—It was hoped to reproduce Major Morgan's plates with this paper, but it has been found impossible to do so. The author invites the special attention of all medical officers of health interested in the subject to these plates, as he considers them the best hitherto published.

July, 1905.

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Dr. T. M. Clayton (M.O.H., Gateshead) said that he agreed with the suggestion of Major Blackham that the subject of tropical diseases was one which should interest medical officers of health generally. He had studied particularly Trypanosomiasis, but generally he found a knowledge of tropical diseases useful even in the town of Gateshead, coming across such cases as malaria, leprosy, elephantiasis, etc. If, therefore, it was useful in Gateshead, it must almost amount to a necessity amongst port medical officers.

Professor Spottiswoode Cameron also took part in the discussion.

[*The Proceedings of the Congress will be continued on page 413.*]

NOTES ON LEGISLATION AND LAW CASES.

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SEWERS.—*Facilities for manufactories draining into sewers—Public Health—Rivers Pollution Prevention Act, 1876 (39 & 40 Vict. c. 75), s. 7.*

The plts., cotton thread manufacturers at Meltham, claimed that they were entitled under s. 7 of the Rivers Pollution Prevention Act, 1876, to facilities for enabling them to carry the liquids from their mills into the sewer under the defts.' control. Sect. 7 provides that "every sanitary or other local authority having sewers under their control shall give facilities for enabling manufacturers within their district to carry the liquids from their factories or manufacturing processes into such sewers . . . . provided that no sanitary authority shall be required to give such facilities as aforesaid where the sewers of such authority are only sufficient for the requirements of their district."

The defts. were possessed of certain pipes or sewers along which they carried the sewage of their district to certain works where they treated it for the purpose of rendering it innocuous, after which treatment they carried the effluent in further pipes to a river, where they discharged it. The pipes of the defts.' sewage system were amply large enough to carry the refuse which the plts. proposed to discharge from their mills in addition to the other sewage of the defts.' district, but the defts.' apparatus for treating the sewage was not sufficient to deal with plts.' refuse in addition to the other sewage.

The county court judge held that the word "sewers" in the proviso of s. 7 included not only the pipes for carrying the sewage, but the whole sewerage system, and that as the system as a whole was only sufficient for the requirements of the defts.' district, without the addition of the plts.' refuse, the defts. were under no obligation to afford the facilities asked for. He accordingly dismissed the application.

Held, following the decision of the Ct. of Sess. in *Guthrie & Co. v. Brechin* (1888) Ct. of Sess. Cas. 4th Series, 385, that the word "sewers" in the proviso meant the pipes alone, and that the measurement of the local authority's capacity referred to in the section was not their ability to dispose of the sewage, but the capacity of the pipes to receive it. Appeal allowed.

Brook Brothers, Ltd. v. Meltham Urban Council. Div. Ct. [1908] W. N. 121. May, 1908.

SEWERS. — *Notice—Local Government—Burgh sewers—Notice in writing to persons interested—Public Health (Scotland) Act, 1897 (60 & 61 Vict. c. 38) s. 103—Burgh Police (Scotland) Act, 1892 (55 & 56 Vict. c. 55) s. 217—Burgh Sewerage, Drainage, and Water Supply (Scotland) Act, 1901 (1 Edw. 7, c. 24), s. 5.*

By the Burgh Sewerage, Drainage and Water Supply (Scotland) Act, 1901, s. 5, "The powers and duties of the town council of any burgh, as the authority under the principal Act" (the Burgh Police Act of 1892), "with reference to sewerage and drainage and water supply shall extend to the whole area of the burgh as existing for the purposes of the Public Health (Scotland) Act, 1897, and the town council of any burgh as the authority under the principal Act, in addition to the powers conferred upon them by the principal Act or any other Act, shall with reference to sewerage and drainage or water supply within such area have the same rights, powers and privileges as are conferred by the Public Health (Scotland) Act, 1897, upon local authorities under that Act in districts other than burghs . . . . and in so far as necessary for giving effect to this enactment the last mentioned Act and the Acts and parts of Acts incorporated therewith are subject to the necessary modifications incorporated with the principal Act." By s. 217 of the Burgh Police (Scotland) Act, 1892, nothing in the Act "shall be construed to authorise the commissioners contrary to any private right to use, injure, or interfere with any sewers . . . . or interfere with any water course . . . . in which the owner or occupier of any land, mills . . . . shall have right or interest, without the consent in writing of the person legally entitled to grant the same." By s. 103 of the Public Health (Scotland) Act, 1897, "The local authority shall have power to construct . . . . such sewers as they may think necessary . . . . and may carry such sewers . . . . after reasonable notice in writing (if upon the report of a surveyor it should appear to be necessary) into, through or under any lands whatsoever."

A local authority having laid sewer pipes upon the surface of the bed of a stream, certain proprietors entitled to notice, who considered that they were prejudiced by the pipes being on the surface instead of under the surface, raised an action in which they demanded the removal of the pipes, on the ground (inter alia) that the notice required by s. 217 of the Act of 1892 had not been given:—

Held (affirming the decision of the Ct. of Sess., (1908) S. C. 127), that, under the Act of 1901, a burgh, in the construction of sewers, can proceed either under the Act of 1892 or the Act of 1897, and that, the local authority having decided to proceed under the Act of 1897, they were not bound to obtain the consent of the proprietors as required by the Act of 1892.

Montgomerie & Co. v. Provost and Magistrates of Haddington. H. L. (Sc.) [1908] W. N. 54; [1908] A. C. 170.

SEWAGE FARM.—*Let by Sewerage Board to Tenant - Poor Rate - Assessment.*

A sewerage farm was let by the owners (the sewerage board) to a tenant:—

Held, that in assessing the tenant to the poor rate in respect of his occupation of the farm, the rating authority, when estimating the rent which a hypothetical tenant would be willing to pay, must take into consideration not merely the actual rent paid by the tenant, but the benefit accruing from the farm as a means of enabling the board to discharge their statutory duties; and that the board was not to be excluded from the list of possible hypothetical tenants.

Decision of the Court of Appeal (1907) 1 K. B. 630 affirmed.

DAVIES v. SEISDON UNION. H. L. (E.) 315 A.C. Pt. III. Aug., 1908.

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JOURNAL

OF

THE ROYAL SANITARY INSTITUTE

CONGRESS AT CARDIFF.

SECTION II.—ENGINEERING AND ARCHITECTURE.

ADDRESS

By SIR HENRY TANNER, I.S.O., F.R.I.B.A.
(FELLOW.)
PRESIDENT OF THE SECTION.

IT is the custom of the presidents of sections to inflict on the members a short address, and generally the matter of it has been concerned with some phase of work in which they are specialists. I am unable to follow this course, because the direction in which I may be said to specialize has no general interest. I propose, therefore, to refer to some matters in connection with building which I think deserve special consideration, and which may be said to come within the aims of The Royal Sanitary Institute.

The architectural and engineering professions are more or less conservative, and changes in building construction and engineering practice are gradual and slow; but there are occasions when some marked departure from the usual methods takes place with apparent speed: this is generally only after long incubation, and there is something more or less out of the ordinary that has led to it.

The introduction of iron joists had a considerable influence on building construction, almost entirely throwing out of use cast-iron or wooden beams; and the introduction of steel further emphasised this change, and for some time past skeleton steel structures have been multiplying. The general desire nowadays is, in regard to the majority of buildings for other than domestic purposes, to provide structures which, while economy has to be duly considered, are the best that can be devised to resist fire: and for this object wood has to be abandoned so far as possible, and all

steel has to be covered with some material which is a bad conductor of heat. Portland cement concrete is being generally used for the purpose. This obviously adds to the cost of such structures. The consequence has been that reinforced concrete, which for the last ten years has been occupying the attention of many people, has almost suddenly burst upon the professions in this country, and has provoked an unusual amount of interest. We are much behind other nations in this respect.

The question of economy and strength, together with lightness, in the first place forced railway and dock companies to take this method of construction into serious consideration. Owing to bad and unequal foundations upon which, in the case of docks, warehouses and other similar structures had to be constructed, lightness and homogenity became important considerations. These qualities have considerable influence on cost, which is small in comparison with the usual brick buildings, while concrete piles, which are practically indestructible, take the place of those of wood. The structures thus erected, such as the warehouses on the quays of the Manchester Ship Canal and the goods warehouse at Newcastle for the North Eastern Railway Company, forced themselves upon the notice of architects, and these came to consider why, if such buildings could be erected for railway and dock purposes, the system should not be utilized for ordinary building objects, such as factories and large structures. The various building regulations have stood in the way of the general use of reinforced concrete because, as in steel frame structures, the outer walls were required to be of the same thickness and strength as if they were intended to carry the superstructure, although there are a few local bodies which have permitted elasticity in this respect. At all events, these regulations in the main only permitted the construction of floors and their supports to do the work required. The obstructions thus raised, and the fact that the whole business was practically in the hands of specialists and patentees, has hindered the more general adoption of this form of construction. It is, however, to be hoped that the rules comprised in the Report, which have been prepared by the committee appointed by the Royal Institute of British Architects, may enable local authorities to establish standards, and thus afford freer facilities for users, and that the members of the profession will find it as necessary and as easy to make calculations as they have done in the case of steel.

Municipalities have largely availed themselves of this method of construction, and no doubt would more extensively do so were loans obtainable for the same term as for the ordinary methods of construction. For instance, sewers can, I believe, be constructed at about half the cost of

those in brick, but as loans can only be procured for half the usual term, which implies some doubt as to the life of such constructions, the preference is given to old forms by bodies who have not sufficient courage to arrive at an independent judgment, consequently double the money is expended that is necessary; and even if reinforced concrete is adopted, the annual payments are the same in amount, although, of course, there is only half the number.

The advantages of reinforced concrete are numerous, although at present there are comparatively few builders or contractors who lay themselves out to execute such works, but the numbers are increasing and will do so more freely so soon as the system of licenses comes to an end, while in course of time, I think, supervision will become more easy as general acquaintance with the construction extends.

Reinforced concrete construction is the best fire-resisting system at which we have yet arrived, assuming that the steel is properly covered, severe fires showing that it suffers little damage, which, however, can easily be made good, and it confines fires within the enclosing area. There results a great saving of space owing to the thinness of the external walls, retaining walls, etc., and it is astonishing what pressures these latter can resist. There is no space for vermin, the solidity of the structures being complete, unless such spaces are required for other purposes. In engineering works the economies should be greater than in ordinary building, retaining walls and bridge work showing remarkable lightness and strength. The objection to the material lies in the necessity for foresight, and the early settlement of such items as in ordinary construction generally lead to a large expense in cutting away, as for lifts, electric lighting appliances, heating apparatuses, and similar services.

The cost of such operations in reinforced concrete demands early consideration and settlement on the part of those responsible. I regard this as a good point as tending to bring these gentlemen up to the scratch, and induce them to make up their minds at an early date instead of postponing everything of the kind till the last moment because "it is so easy to cut holes when and where they are wanted," frequently at those places which have no superfluity of strength. I anticipate that some difficulty may arise in plastering and other internal and external finishings, owing to the non-porosity of the material, and therefore the want of adhesion consequent thereon. However, I have no doubt that this difficulty will be surmounted, and that externally, at least, it will be found possible by the use of suitable moulds to leave the surfaces from those moulds. This I am partially doing already, and in regard to treatment externally there is

abundant room for the invention of designers. I find that a 7 in. or 8 in. wall against earth can be made impervious to moisture, there must therefore be a reduction of air passing through as compared with ordinary walls, which should be considered in connection with ventilation problems.

The simplicity of the construction alters the proportion of the trades employed, carpenters taking the place of bricklayers, while labourers can no longer be employed to construct centering as is now the case, but their numbers are largely increased. Consequently, during the construction of the carcase carpenters and labourers are employed in something like the proportion of 2 to 5, bricklayers being seldom needed. The material consisting of round rods, cement, sand and aggregate, there is little trouble in obtaining them, and the delays attending built up girders and other forms of construction are in the main avoided.

Doubts have been raised as to the stability of this form of construction, but I think that these need not cause any anxiety to those who use it. It has been repeatedly shown that the steel does not oxydise when covered with concrete such as is used for the purpose, and that accidents, none of which have occurred in this country, have all been traced to causes which should not have existed. The explanation of that at Milan in April last has not, so far as I know, reached this country, but the photos which I have seen would imply bad or imperfectly-set concrete. Of course, if the work is not properly designed and carried out accidents must occur, as in any ordinary form of construction.

The sanitary principles which should apply to the planning and arrangements of buildings are now very generally understood, but it seems to me that the stringent tests which are employed for drains must lead to the abandonment of salt-glazed stoneware pipes, as no drain formed of such pipes is likely to stand the usual tests after a few years. This I look upon as unfortunate, because a slight leakage outside the area of any building cannot give rise to any harm, and, moreover, there are very few street sewers that could stand similar tests. Having regard, however, to the probability of having to relay such drains after a few years if no leakage is to be permitted, there is no alternative but to use iron pipes throughout, although personally I have a preference for the stoneware.

Plumbing work can now be done in the most excellent manner, and the action of the Plumbers' Company, with the able co-operation of its Master and Clerk, has tended to produce a body of workmen who thoroughly understand the objects of the work they do and who are first-class craftsmen. The payment made to them is no more than to others, and I therefore strongly recommend that such men should have the

preference for sanitary works at least, and that encouragement be thus given to men to join the ranks of certified plumbers.

The great diversity of the requirements of local water authorities renders it important that water fittings should be standardized, and that what is found to be good for its purpose and approved by one company should meet the requirements of another. Some public authority should set up the necessary standard, of which there should be two classes as regards strength. I suppose that the limit of water waste preventers to two gallons will remain, but the quantity is meagre, is certainly the minimum, and often leads to a double consumption. I prefer larger cisterns, and use them where the regulations do not apply, as is usual with meter supplies, but even then authorities will not consent to cisterns of larger capacity. Another half-gallon would be of decided advantage. The two-gallon supply requires careful adjustment in all parts of the apparatus.

I desire to draw attention to the question of paint. Hitherto white lead has formed the chief ingredient, and as it has very deleterious effects on the health of the workpeople engaged in its manufacture, and upon those using it, unless special precautions are taken, and which are always difficult to enforce, it is most desirable that its use should be limited or discontinued. The latter, I believe, has been done in France, zinc oxide, ordinarily known as zinc white, being substituted. The matter was taken up by the Home Office some time ago. There is much prejudice against the use of zinc white, the majority of painters preferring white lead without having taken any adequate steps to ascertain what the substitute is capable of, but at the same time the use of zinc white is growing extensively, owing chiefly to its being largely employed in the manufacture of ready-mixed paints having well-known names. Very few painters, however, are aware of this fact, as although in favour of white lead they frequently uphold various brands of zinc paints. Zinc white is especially useful for painting in white or light tints, as it changes very little in colour on exposure; so different to white lead, which turns to a yellow tint. It is innocuous, and it is the duty therefore of all those having the opportunity to require its use in preference to white lead.

It is little understood, and education is required, but I am convinced that better work can be done with such paint at certainly not greater cost if the right materials are employed in suitable proportions, while its lasting qualities in some situations, especially where exposed to sea atmosphere, are much superior. Owing, as I have said, to the want of

knowledge in regard to it the paint should be obtained ready mixed from trustworthy manufacturers, which will lead to satisfactory results, and I have found that, if carefully used, two coats can be made to cover new plaster work on walls in a satisfactory manner with suitable colours. The materials should be zinc oxide (not more than 2 per cent. of impurities), refined boiled linseed oil, and oil varnish. Mixing by hand should be deprecated.

The question of smoke abatement with reference to household fires is one of considerable importance, and a short time ago the Smoke Abatement Society carried out a series of experiments with a variety of grates and gas stoves with the assistance of H.M. Office of Works. The report on grates will be found in the *Lancet* for 19th May, 1906. The number of grates submitted for test was considerable, but did not include all descriptions; though the numbers and forms were sufficient to enable one to arrive at a fairly accurate idea of the design which might be expected to give out the maximum of heat with the least expenditure of coal and smoke. Four makes of grates were found to give about equal results; but they vary considerably in pattern, the only common point being that the backs sloped upwards and towards the room more or less, an arrangement which has been regarded for years as necessary to ensure consumption of smoke. In one case the basket projects considerably into the room, and three have bottom bars and ash pans or frets, forming them into slow-combustion stoves. From examination of the several patterns I came to the conclusion that the fire-basket should be shallow in depth, project slightly into the room and be furnished with an adjustable blower, while the firebrick should be substantial in thickness. With the kind of stoking that is customary in private houses freedom from smoke cannot be expected, and still less can it be hoped for in connection with the kitchen range; this is probably the worst offender and is going all the year round instead of only during the cold weather, as in the case of grates.

Drs. Parkes and Des Vœux in their paper read before this Institute in November last year advocated gas, and in the case of large buildings hot water or steam heating. Except in cases of intermittent use there is no doubt that the cost of gas is much in excess of that of a coal fire, and this will prevent its adoption in the majority of cases, and in regard to hot water or steam heating one is faced with a demand for artificial ventilation, even in cases of ordinary occupation. This is serious, and while adding to the general expense is open to the objection that constant adjustment is required. There is no doubt that in the case of office buildings hot water or steam heating has the advantage, the former by

preference. The warmth is more evenly distributed, and the general experience is, I believe, that there is greater freedom from catarrh and other similar complaints, corridors and entrances being warmed in the general scheme, and so far as my experience goes in the case of offices occupied for some seven or eight hours per day the use of mechanical ventilation is by no means proved to be necessary, provided fresh air is passed through the radiators, and that there are other means of air inlet and exhaust flues. The case is, of course, different where large, numbers are assembled in one room. Apparently there is little objection to the open gas fire, but closed ones are to be avoided owing to their liability to go wrong, and then the products of combustion escape into the room. A number of gas stoves were experimented with in the same room as the grates, and the full report will be found in the *Lancet* for 17th November, 1906. Dr. Rideal's experiments on the effects of gas combustion and electric lighting on the atmosphere of a room are interesting in this connection, as they show that gas is much less innocuous by comparison than was generally supposed.

This city, Cardiff, is marked by the general progress which it has made in recent years. It has provided new administrative buildings and new law courts, while the docks continue to expand and enlarge, and it is a most appropriate place in which to hold this Congress; the visit can only be of advantage to the members of the Institute.

CARDIFF CORPORATION WATERWORKS.

By C. H. PRIESTLEY, M.Inst.C.E.,
City Waterworks Engineer, Cardiff.
(MEMBER.)

IN the year 1850 the population of the town of Cardiff was about 18,000, and up to this time the people were dependent upon wells and the water which was procured from the Dock Feeder, the River Taff, etc. Many of these wells were of doubtful purity, and in some cases private wells were in close proximity to cesspits and other fruitful causes of disease. In fact, only two years before this a cholera epidemic occurred in the town, over 350 deaths resulting therefrom. In 1850 a company was formed for the purpose of supplying water to the town, port, and neighbourhood. Parliamentary powers were obtained, which the company proceeded to put into operation. The first works constructed were near the River Ely, at the village of that name, about three miles from the City Hall. A pumping station was erected, and the water taken from the river, roughly filtered, and pumped into a service reservoir at Penhill, near Llandaff, from which the town was supplied by gravitation. Although this water was charged at a comparatively cheap rate, a large number of the existing wells still remained in use, and it was many years before these wells were entirely disused. From 1851 to 1861 the population very nearly doubled, from 18,000 to 33,000.

The consumption having increased accordingly, it became necessary to seek for further sources of supply, and the waterworks company obtained an Act of Parliament in 1860 for a gravitation scheme at Lisvane, four miles north of Cardiff, in addition to their powers at Ely. The works constructed there included a storage reservoir with a capacity in the first instance of 60 million gallons, afterwards increased to 80 million gallons, into which the water of a number of streams on the gathering ground of over 2,000 acres were conveyed. This gathering ground extends on the north towards the Caerphilly Hills, and east to Cefn-Mably Park. Sand filter beds were also constructed near the reservoir, together with a trunk main to the town. By the same Act the company's water limits were greatly

extended, including a large number of the surrounding parishes, many of which have since become populous, especially the seaside town of Penarth. Subsidiary service reservoirs and pumping stations at Cogan and Llandough were erected for the supply of the Penarth district. For a considerable time after the construction of the Lisvane Reservoir it was unnecessary to pump water from the River Ely; but as the population continued to increase very rapidly this source was again brought into operation: and to improve the quality of the water culverts were constructed alongside the river, which received water from a number of springs and from the higher ground by percolation. After the construction of these culverts the water was not taken from the river except occasionally in times of drought. The waterworks company continued to supply the town and district from these sources up to 1878.

The company then found it necessary to provide for a rapidly increasing population, and promoted a Bill in Parliament for further works and extensions at the Ely Pumping Station, and at Llanishen adjoining the Lisvane Reservoir. The Lisvane Reservoir had already been increased to a capacity of 80 million gallons.

In the meantime it had been felt by many of the inhabitants and members of the council that it would be in the interests of the consumers if the water-supply could be in their own hands. The Corporation were also advised that the proposed extensions were not of such a comprehensive character as to provide adequately for future wants. It was therefore decided by the council to oppose the company's Bill with a view to purchasing their undertaking. Negotiations were entered into with the company prior to the Bill coming before the Committees of the Houses of Parliament, and an understanding was arrived at whereby the Corporation were to pay £300,000 to the waterworks company for their undertaking. The Bill was then allowed to proceed without opposition from the Corporation, and obtained the Royal assent in July, 1878. The Corporation in the following year received Parliamentary sanction to purchase the works and borrow the money therefor, the purchase being completed and the works taken over by the Corporation on the 29th of September, 1879.

Following the purchase the waterworks committee took into consideration the whole question of supply with a view to constructing such works as might adequately meet the ever increasing needs of the town and district, and instructed their engineer to report generally upon all available sources of supply within reasonable distance of Cardiff. A scheme was eventually decided upon after much discussion, and on the advice of one of the most eminent water engineers in the kingdom, which was

known as the Taff Fawr or Brecon Beacons scheme. To meet the immediate requirements a reservoir of over 300 million gallons capacity was constructed adjoining the existing Lisvane Reservoir, this work having been authorised under the Company's Act of 1878.

Taff Fawr Scheme.—This scheme included the construction of three large reservoirs in the Taff Fawr valley, over 30 miles from Cardiff, the highest of these being at the foot of the Brecon Beacons, and the lowest (yet to be constructed) being about five miles above the borough of Merthyr Tydfil, with a pipe-line or conduit running therefrom to the Llanishen reservoirs near Cardiff, and with balancing reservoirs as required *en route*. Parliamentary powers were obtained in 1884 for the impounding of the waters of the River Taff Fawr and the construction of the above works.

The watershed was divided into two areas in order that the reservoirs might be built as required, the upper area containing 4,000 acres and the lower area 6,400 acres of gathering ground. The sites of the two reservoirs are on the Old Red Sandstone formation, which is considered one of the best upon which to build watertight dams. It is outside the area of the South Wales coalfield, and some distance from the Mountain Limestone near Cefn Coed. Two out of the series of three reservoirs have been constructed on what was before mentioned as the upper area: the Beacons reservoir, which is at the foot of the Brecon Beacons, and has a capacity of 345 million gallons and a top water level of 1,340 ft. above ordnance datum, the Cantreff reservoir, some three miles lower down, which has a capacity of 323 million gallons and a top water level of 1,073 ft. above ordnance datum. The conduit and balancing reservoirs above mentioned were constructed at the same time as the Cantreff reservoir, the first portion of the supply from the Taff Fawr source being brought down to Cardiff in 1889, and the first section of the works included above completed in 1897. Compensation water has to be delivered into the river on account of the upper area to the extent of three million gallons per day. It is now proposed to go on with the construction of the third reservoir of the series which will have a capacity of over 900 million gallons and a top water level of 844 ft. above ordnance datum. When this reservoir is constructed a further quantity of $4\frac{3}{4}$ million gallons per day compensation water will have to be given to the river. The works already constructed in the Taff Fawr valley were designed and carried out by Mr. J. A. B. Williams, M. Inst. C.E. who was the waterworks engineer to the corporation up to 1895.

Simultaneously with the construction of the balancing reservoirs and

the Taff Fawr conduit, new filter beds and service reservoirs were built at the Heath, 1½ miles from the city hall, for the low-level service, and at Rhubina, 4½ miles from the city hall, where the last balancing reservoir for the high level service is also constructed. It has been necessary since this date to considerably enlarge the works at both these places, and also to construct several subsidiary service reservoirs and other works, in different positions near the city.

The population at present supplied by the corporation is estimated to be 222,000, of which over 30,000 are outside the city limits. The ordinary consumption of water averages about 6½ million gallons per day, which in dry weather rises to a maximum of over 7½ million gallons. For the year 1907 the actual average was 5,961,233 gallons per day, or 27·34 gallons per head on the then estimated population of 218,000. Out of this quantity 11 gallons per head was sold by meter for trade and municipal purposes, thus leaving a domestic consumption of between 16 and 17 gallons per head. There are no extra charges in Cardiff or the district of supply for any domestic purpose in addition to the water-rent payable in accordance with the rating of the property, which for all houses of over £20 ratable is 1s. in the £. There is no incentive, therefore, to restrict the use of water, and private baths are very general in all classes of property, even cottage-houses of £20 rental and under being provided therewith, thus helping to promote cleanliness and sanitary conditions amongst the people.

Since the waterworks undertaking has been in the hands of the corporation a full and constant supply for domestic purposes has always been maintained, with the exception of a short period during the dry season of 1887, and the legitimate use of water for all purposes has been encouraged.

The water being very soft, having from two to three degrees of hardness only, is suitable for all purposes, both domestic and trade consumption, and the chemical and bacteriological examination thereof always shows a high degree of purity.

Mr. John S. Brodie (Blackpool) inquired whether Cardiff was altogether a water-closet city, as, if that was so, the extremely low consumption per head of the population for domestic purposes (sixteen to seventeen gallons) was evidence of a most successful management.

Mr. G. William Lacey (Oswestry) said he noticed in Mr. Priestley's description of the works that no mention was made of mechanical filters,

whereas he believed that some were in use. He would like to know what make of filters was used and what were the results obtained from them, and how they compared with the results from the ordinary sand filters.

Mr. Arthur J. Martin (Westminster) asked whether water for gardening purposes was supplied by meter or otherwise, and whether the water so used was included in the seventeen gallons per head per day?

Mr. T. Reader Smith (Kettering) put a question as to whether, if the gathering ground had not been purchased, the corporation had any sanitary control by by-laws sanctioned by the Local Government Board, or by any special clause in this Act, which permitted of proper supervision of the area. Under a recent Water Act the Kettering Urban District Council had power to make by-laws for the protection of the gathering grounds for their reservoirs, and he was anxious to learn what other authorities had similar powers, and in what way they were making use of them.

Mr. Arthur J. Abbott (Yeovil) asked whether the amount of compensation water returned to the river prevented cause arising for claims in respect of loss of water by tenants or others on lands outside the gathering area?

In the event of a compensation claim being sustained, did the Act provide a time limit within which such claims could only be made; if so, what period?

Mr. Priestley (Cardiff) in replying, dealt first with the question as to the filtration of the water. The water came down from the Taff Fawr works, and they had ordinary sand filters for the high-level service, the water being passed through these and distributed. The water for the low-level service passed into the reservoirs at Llanishen and Lisvane, and there was no doubt that the subsiding reservoirs they had there were of great advantage to the water, the water delivered on to the filter-beds at the Heath being much better than when taken from the conduit into the Rhubina reservoirs. The longer the water was kept in the subsiding reservoirs the better the colour. A considerable amount of peaty matter was taken out, but a large proportion was left, and the acid from the peat had a very bad effect on the pipes. The delivering capacity of the pipe-line was originally 12,000,000 gallons a day, but it was now reduced by incrustation at least 25 per cent.

Cardiff was entirely a water-closet town, there being no other means of getting rid of the excreta.

Candy filters were in use at the Heath, but only to a limited extent at present, between 5,000,000 and 6,000,000 gallons being passed through the sand filters, while only 750,000 gallons went through the mechanical filters. The latter had been put down on economical grounds, and had proved a success,

the analyses obtained in connection with their operation being equal to those from the sand filters. Sometimes these varied a little.

The gathering ground of the impounding reservoirs had not up to the present been purchased by the corporation. He had urged that this was a desirable step to take, but although the matter had been taken into consideration some time ago, nothing had been done. There was only one house on the gathering ground.

They had a system of waste water prevention, Deacon's meters being in use, supplemented by house-to-house inspection. They were, however, helped in this connection by the very low pressure on the low level, this being not more than 35 lbs. per square inch over any part of the city. They could do with more, but the position of the filter-beds prevented it. The water for gardening purposes was included in the 17 gallons per day. They allowed the use of water with cans, but if a hose were employed a charge of 10s. per year was imposed, and the hose had to be held in the hand. When sprinklers were used meters had to be rented.

The consumption for trade purposes probably looked high, but large quantities of water were used at the Dowlais works, on the railway and at Penarth Dock, some of their consumers taking as much as from 30,000,000 to 35,000,000 gallons every quarter.

No claims had been received for additional compensation. He could not say what the waste of water per head amounted to exactly, but it varied very considerably. If it did not show more than 2 or 3 gallons per head on the waste water diagrams they did not trouble, but if more they made an inspection of the district affected. It was a great advantage to have these waste-water meters.

The information desired in regard to the balancing reservoirs was rather a large order, but he would be glad to show the questioner the plan, and provide him with particulars, at another time. The reservoirs in question were intended to break the pressure which would otherwise be carried in the pipes.

Mr. Walker Smith and Mr. W. Hall also took part in the discussion.

SOME RECENT EXPERIMENTS ON THE BIOLYSIS OF SEWAGE.

By W. D. SCOTT-MONCRIEFF.
(FELLOW.)

SEVENTY pages of Mr. Martin's masterly *résumé* of the evidence given before the Royal Commission on Sewage Disposal are devoted to the subject of preliminary treatment, and nine-tenths of this refers to the subject of anaërobic hydrolysis. When one of the principal witnesses was asked if he had any information as to the advantages to be derived from letting the sewage remain "longer or shorter," he answered "No; I have not got that information." Other witnesses among the many distinguished experts who gave evidence seemed no better able to give a satisfactory reply, and yet the information asked for is absolutely the only basis upon which the proper dimensions of liquefying tanks can be determined. These remarks are intended to show that some steps should be taken to place the subject of sewage purification upon a more rational footing.

The experiments to be described dealt with the discharge from ten workmen, more or less, the measure of actual pollution being ascertained in every case from the chlorine content of the sewage. The immediate objects of the investigation were to discover, first, What were the periods of hydrolysis that gave the necessary standard of purification under measured conditions of flow, and periods between each discharge of the septic effluent upon the filtration surface; and, second, to discover if filtration under these measured conditions through given materials would yield the required standard of purification at the maximum filter depth available, which happened to be three feet. The information obtained from the first would regulate the dimensions of the hydrolysing tanks, and from the second would regulate the dimensions of the filters. By halving the rate of flow it was found that the nitrification of the filtered effluent was almost exactly doubled, and, if the higher nitrification had been necessary, it is obvious that this could only have been obtained by doubling the capacity of the filters.

The experiments were carried out on behalf of a Committee of the Surrey County Council *and were confined to the two objects mentioned.*

Temporary closets and urinal accommodation were provided for the use of 10 persons. The closets were flushed by means of a 25-gallon cistern which was actuated by an electrical connection to the office of the clerk of works, who kept the keys to the closets. On the keys being returned to the office a flush was given by touching a button. In addition to the 25-gallon cistern there was one with a capacity of 50 gallons which was used for flushing the urinals with waste preventing cisterns and for the supply of two washhand basins. This 50 gallon cistern was used through the day and emptied every night, so that the total water supply was 10 times 25 gallons for the closets and 50 gallons for urinals and washhand basins, making in all 30 gallons per head per day. The whole of the drainage system was newly laid so that the biolytic changes that occurred were absolutely confined to the work of the organisms of the alimentary canal and their enzymes. The sewage first passed through a detritus chamber, measuring 3 ft. by 2 ft. and 2 ft. deep, fixed on the line of the drain, about 100 yards from the closets, and this was provided with two slate dipstones with their bottom edges 6 inches from the bottom. This arrangement is intended to serve the purpose of an additional grease trap as well as a detritus chamber. After passing through this chamber the sewage was conveyed in an iron drain 5 in. in diameter to a cultivation-tank measuring 10 ft. long by 3 ft. 9 in. wide by 3 ft. 2 in. in depth; this had a sloping bottom and was filled with large flints which occupied half its cubic content, leaving a liquid capacity of exactly 250 gallons. It will be noticed that the arrangements allowed of an accurate estimate of the time during which any portion of the sewage remained in the tank, seeing that what came in the morning as it passed under the flints and was regularly displaced in an upward direction by subsequent discharges of the cistern could be subjected to any desired period of hydrolysis with great accuracy. By taking a sample in the morning it would be that of a discharge that had occurred at some particular hour of the previous day, and by taking a sample in the afternoon it would be that of a particular discharge of the same day. By taking a sample on Monday morning it would be that from a discharge on the previous Saturday as the closets were only used twice on Sunday.

After passing through the hydrolysing cultivation tank the sewage passed into a small sump from which it was continually overflowing and from which a portion was pumped up and continuously discharged, first into a gauging box and then with an accurately measured flow on to the upper surface of

the filtering material of the Testing Apparatus. This was the standard machine which has already been described in the *Transactions of The Royal Sanitary Institute*, vol. xxiv., part iii., page 460, and which has been adopted by the Indian Government and by *La Caisse Nationale des Recherches Scientifiques*, in France. The rate of flow was regulated up to 1,000,000 gallons per acre, per 24 hours, and the period between each discharge on the filter to the same as that of the Ashtead experiments, namely, seven and a half minutes. This was readjusted so as to remain the same when the flow was reduced to 500,000 gallons per acre, per 24 hours, and was so exact that the tipping had the accuracy of a clock. There should be no difficulty in having the same accuracy in the largest installations. The immediate object of the experiments was to arrive at the dimensions of the cultivation tanks required for a population that might vary from four or five persons to as many as a hundred, and to discover under what conditions an available filtering depth of 3 feet would give the required standard of purity. The testing apparatus provided for samples being taken from every foot of filtering depth up to six, but samples were only drawn from the 2nd, 3rd, and 4th foot, as those covered the ground as regards the immediate points that required investigation.

The filtering material was composed of saggars as used at Hanley, in three grades of four inches each, the finest on the top, making up one foot, followed by local gravel graded to an average size of about three-quarters of an inch.

Before referring to the analyses in detail it may be well to make one or two observations upon the irregularity that must necessarily occur in every installation, large or small, due to the different conditions prevailing at different periods of the day, such as occur at noon after a large flow of the strongest sewage, or in the early morning when one part of the sewage has been a long time in the tank, and so on: the effects of these have never been estimated with any accuracy for lack of the necessary apparatus, but when this is available, as in the case of these Clandon experiments, it is now shown, I believe for the first time, to what extent a well matured filter, worked under proper conditions, is capable of dealing with the polluting organic matters under widely varying conditions as regards different periods of hydrolysis.

It should be noted that the results obtained are strictly confined to the conditions that produced them, and that they do not justify any generalisations unless these are based upon a very careful consideration of the actual facts. For instance, although there is the most explicit evidence

that the filter was capable of purifying the sewage to a fairly high standard under widely different periods of hydrolysis, it by no means follows that if it had been dealing with fresh sewage from the first it would ever have become equally active, or that if it had been dosed all along with sewage that had remained 17 hours in the tank, it would have been equally efficient.

Referring to the experiments which are set forth in tabular form, it will be noted that they were commenced when the cultivation tank had been at work from the 23rd of September, 1907, to the 22nd of January, 1908, a period of 121 days, while the testing filter was started on the 4th of December, 1907, and had a maturity of 49 days. The first two experiments had an interval of seven days between them, and were intended to discover if the conditions were so uniform as to give identical results, in other words, to find if the apparatus was reliable. *Taking the figures from the depth of three feet*, which was the maximum available without pumping in the installation itself, it will be noticed that the strength of the sewage as gauged by the chlorine content was practically the same, but that there was a slight improvement under the heads of albuminoid ammonia, oxygen consumed and nitrates. This might reasonably have been expected as the result of the progressive maturity of the filter.

In the third experiment the capacity of the cultivation tank was reduced to one-half by tapping it lower down so that the hydrolysis could be reduced from 22 hours to 4 hours. The sewage was stronger in the ratio of 4·28 to 3, the albuminoid figure remained nearly constant, and the nitrates were rather more than doubled.

In the fourth experiment the strength of the sewage was exactly doubled by the simple expedient of halving the supply of water, and the hydrolysis was altered to 47 hours, by taking the samples at noon on Monday so that they represented the discharges of the previous Saturday, the closets only having been used twice or three times during Sunday, which was not sufficient to displace the mid-day discharges of the previous day. Here we find that the lengthened period of anaërobic fermentation had the effect apparently of making the organic nitrogen more refractory to the nitrifying work of the filter, seeing that the ratio between the nitrates and the chlorine in the third experiment was as 1·6 to 4·28, and in the fourth it had fallen to 1·4 to 8.

In the fifth experiment the tank capacity remained at 125 gallons and the gallons per person 15, but the hydrolysis was reduced to 9 hours. Here we find the free ammonia has been greatly increased as compared with the third experiment, the chlorine content of the tank effluent being

about the same, while the oxygen consumed has been reduced by more than 50 per cent., and the albuminoid and nitrate figures are about the same.

In the sixth experiment the effects are shown of reducing the rate of flow by one-half, that is to say, from 1,000,000 gallons to 500,000 per acre per 24 hours, while the periods between the charges were the same, $7\frac{1}{2}$ minutes. The result was that the free ammonia had disappeared, the albuminoid ammonia remained about the same, and the nitrates were increased by about 30 per cent., as compared with the third experiment with a 4 hours' hydrolysis and a chlorine content identically the same.

In the seventh experiment a period of fourteen days was allowed to elapse in order to allow ample time for the filter to adjust itself to the changed condition of taking the sewage from a point below the small detritus chamber without its having passed through the cultivation tank at all. The results were that the nitrification was about the same as in the third experiment, the free ammonia had again disappeared, the albuminoid ammonia had slightly decreased, the oxygen consumed was reduced by more than 50 per cent., and the nitrates were about the same, while the chlorine contents were identical.

The upshot of the experiments, from a practical point of view, was that a sample of effluent could be handed to the committee of what might be expected when the maximum number of inhabitants were in residence and the installation constructed on the information actually obtained. How many millions of money would have been saved to the long suffering British ratepayers if similar information had been available in every case!

It should be added that in order to avoid excessive discharges of liquid that would be far beyond the capacity of the filter to deal with the discharge from the laundry is separately dealt with, through open-jointed earthenware drains laid in loose ballast below the level of the ground.

Analyses of Samples from Cultivation Tank and Sewage Tester.

EXPERIMENT No. 1.

Date.	Day.	Hour.	Daily Flow.	Gallons. 6.30 a.m. 5.30 p.m.	Liquid Capacity of Cultivation Tank.	Gallons per Person.	Rate of Flow per Acre per 24 hours.	Period between each Discharge.	Hydrolysis.
1908. Jan. 22	Wednesday.	4 p.m.	300 gals.	300	250 gals.	30	1,000,000 gals.	7½ min.	22 hours.

	CULTIVATION TANK	FILTER DEPTH.		
	Parts per 100,000	2 feet	3 feet	4 feet
Odour	Offensive	None	None	None
Sediment on standing	Slight	None	None	None
Appearance	Cloudy	Clear	Clear	Clear
Free ammonia	·32	·16	·12	·08
Albuminoid ammonia	·26	·08	·16	·06
Oxygen consumed in 4 hours ...	·48	·06	·16	.06
Chlorine	4·3	3·4	3·1	3·0
Nitrate	Nil	·5	·6	·5

Cultivation Tank started September 23rd, 1907. Filter December 4th, 1907.

EXPERIMENT No. 2.

Date.	Day.	Hour.	Daily Flow.	Gallons. 6.30 a.m. 5.30 p.m.	Liquid Capacity of Cultivation Tank	Gallons per Person	Rate of Flow per Acre per 24 hours.	Period between each Discharge	Hydrolysis.
1908. Jan. 29	Wednesday.	4 p.m.	300 gals.	300	250 gals.	30	1,000,000 gals.	7½ min.	22 hours.

	CULTIVATION TANK.	FILTER DEPTH.		
	Parts per 100,000.	2 feet.	3 feet	4 feet
Odour	Slight	None	None	None
Appearance	Cloudy	Clear	Clear	Clear
Sediment on standing	Slight	Slight	None	None
Free ammonia	·4	·16	·12	·08
Albuminoid ammonia	·16	·09	·08	·06
Oxygen consumed in 4 hours ...	·24	·16	·08	·16
Chlorine...	3·5	3·0	3·0	4·0
Nitrate	Nil	·5	·7	·7

Cultivation Tank started September 23rd, 1907. Filter December 4th, 1907.

EXPERIMENT No. 3.

Date.	Day.	Hour.	Daily Flow.	Gallons 6.30 a.m. 7.30 p.m.	Liquid Capacity of Cultivation Tank	Gallons per Person	Rate of Flow per Acre per 24 hours.	Period between each Discharge	Hydrolysis.
1908: Feb. 19	Wednesday.	4 p.m.	300 gals.	300	125 gals.	30	1,000,000 gals.	7½ min.	4 hours.

	CULTIVATION TANK.	FILTER DEPTH.		
	Parts per 100,000	2 feet.	3 feet.	4 feet.
Odour	Offensive	None	None	None
Appearance	Cloudy	Clear	Clear	Clear
Sediment on standing	Slight	Slight	Slight	Slight
Free Ammonia	1·6	·4	·24	·4
Albuminoid ammonia	·18	·08	·09	·08
Oxygen consumed in 4 hours ...	·8	·64	·72	·64
Chlorine	5	4·28	4·28	4·28
Nitrate	Nil	1·4	1·6	1.6

Cultivation Tank started September 23rd, 1907. Filter December 4th, 1907.

EXPERIMENT No. 4.

Date.	Day.	Hour.	Daily Flow.	Gallons. 6.30 a.m. 7.0 p.m.	Liquid Capacity of Cultivation Tank.	Gallons per Person.	Rate of Flow per Acre per 24 hours.	Period between each Discharge	Hydrolysis
1908. Mar 2	Monday	12 noon.	150 gals.	150	125 gals.	15	1,000,000 gals.	7½ min.	47 hours.

	CULTIVATION TANK	FILTER DEPTH.		
	Parts per 100,000	2 feet.	3 feet.	4 feet
Odour	Offensive	Slight	None	None
Sediment on standing	Slight	Slight	Slight	Slight
Appearance	Cloudy	Clear	Clear	Clear
Free ammonia	2·4	1·2	1·0	·8
Albuminoid ammonia	·24	·11	·10	·09
Oxygen consumed in 4 hours ..	·56	·48	·48	·56
Chlorine...	10	8	8	8
Nitrate	Nil	·9	1·4	1·1

Cultivation Tank started September 23rd, 1907. Filter December 4th, 1907.

EXPERIMENT No. 5.

Date.	Day.	Hour.	Daily Flow.	Gallons. 6.30 a.m. 6.30 p.m.	Liquid Capacity of Cultivation Tank.	Gallons per Person.	Rate of Flow per Acre per 24 hours.	Period between each Discharge.	Hydrolysis.
1908. Mar. 6	Friday	5 p.m.	150 gals.	150	125 gals.	15	1,000,000 gals.	7½ min.	9 hours.

	CULTIVATION TANK.	FILTER DEPTH.		
	Parts per 100,000.	2 feet.	3 feet.	4 feet.
Odour	Offensive	Slight	None	None
Sediment on standing	Slight	Slight	Slight	Slight
Appearance	Cloudy	Clear	Clear	Clear
Free ammonia	2	2	1·2	1·6
Albuminoid ammonia	·24	·12	·1	·09
Oxygen consumed in 4 hours	·8	·48	·32	·32
Chlorine	5·5	5·5	5·5	5·5
Nitrate	Nil	1·4	1·4	·9

Cultivation Tank started September 23rd, 1907. Filter December 4th, 1907.

EXPERIMENT No. 6.

Date.	Day.	Hour.	Daily Flow.	Gallons. 6.30 a.m. 6.30 p.m.	Liquid Capacity of Cultivation Tank.	Gallons per Person.	Rate of Flow per Acre per 24 hours.	Period between each Discharge.	Hydrolysis.
1908. Mar. 11	Wednesday.	5 p.m.	150 gals.	150	125 gals.	15	500,000 gals.	7½ min.	9 hours.

	CULTIVATION TANK.	FILTER DEPTH.		
	Parts per 100,000.	2 feet.	3 feet.	4 feet.
Odour	Offensive	Slight	None	None
Sediment on standing	Slight	Slight	Slight	Slight
Appearance	Cloudy	Clear	Clear	Clear
Free ammonia	2	·0	·0	·0
Albuminoid ammonia	·32	·14	·12	·11
Oxygen consumed in 4 hours	·64	·48	·16	·16
Chlorine	4·28	4·28	4·28	4·28
Nitrate	Nil	1·6	2·2	2

Cultivation Tank started September 23rd, 1907. Filter December 4th, 1907.

EXPERIMENT No. 7.

Date.	Day	Hour.	Daily Flow	Gallons. 6.30 a.m. 6.30 p.m.	Liquid Capacity of Cultivation Tank	Gallons per Person.	Rate of Flow per Acre per 24 hours.	Period between each Discharge	Hydrolysis
1908. Mar. 25	Wednesday.	12 noon.	300 gals.		Nil	30	1,000,000 gals.	7½ min.	Raw Sewage

	CULTIVATION TANK.	FILTER DEPTH.		
	Parts per 100,000.	2 feet.	3 feet.	4 feet.
Odour	Slight	None	None	None
Appearance	Cloudy	Clear	Clear	Clear
Sediment on standing	Slight	Very slight	Very slight	Very slight
Free ammonia	1·2	·08	·0	·0
Albuminoid ammonia...	·18	·09	·075	·065
Oxygen consumed in 4 hours ..	·64	·48	·32	·32
Chlorine...	4·28	4·28	4·28	4·28
Nitrate	Nil	1·4	1·4	1·6

Mr. Arthur J. Martin (Westminster) said he would like to make a few observations on the experiments of the author. The sewage dealt with in the experiments was almost entirely a water-closet sewage; and, further, he had a very large water supply, thirty gallons per head per day. It was obvious that the results from that sewage, which was simple in its character, were not necessarily an index to what one might expect in dealing with ordinary domestic sewage containing soapsuds and kitchen waste of all kinds. The author himself warned them against generalising too much from those results, and said that these results were strictly confined to the conditions which produced them. He would like to ask whether those analytical tables were not as a rule based on single analyses? They would have been more valuable if they could have had averages, but at the same time he recognised the difficulty and expense which that would have involved. They ought to be grateful to Mr. Scott-Moncrieff for what he had given them rather than carp at the results because he had not given them more.

One other lesson which seemed to come out of those experiments was the wide range of time which apparently might be allowed for the hydrolytic changes without to any great extent detracting from the work of the filters. In the fourth experiment certainly the proportion of nitrates was less than in some of the other experiments, but if they looked at the albuminoid ammonia and bore in mind that the sewage dealt with was twice as strong as in the other experiments, they would see that with forty-seven hours' hydrolysis they got very good results in the filter. After all, time alone was not the governing consideration.

It was a question of the amount of work done, and the amount of work done in hydrolysis depended, not only on time, but also on other factors, such as temperature. The importance of temperature as affecting the work of a septic tank was well shown by Dr. Fowler, of Manchester, in his report to the Congress on Hygiene held at Berlin last year. Dr. Fowler also mentioned a series of laboratory experiments which he carried out for the purpose of determining the duration of the tank treatment required by the concentrated sewage with which he had to deal in India. For a sewage of five gallons per head per day he recommends a stay of three days in the tank. He states, in conclusion, that "the capacity must be carefully considered in relation to the number of users rather than the volume of the sewage."

Mr. Thos. R. Smith (Kettering) said he wished to ask a question on experiment No. 3. He understood the author to draw attention to the satisfactory nitrification shown here after only four hours' hydrolysis. At the same time the reduction in oxygen consumed was very small, practically nil, only from 0·8 to 0·72 parts per 100,000. He would be glad to know whether it was to be understood that this effluent was in a particularly favourable condition for further reduction in oxygen consumed, or what deduction was to be made from those figures. In the other experiments with longer periods for hydrolysis the reduction in oxygen consumed was much greater.

Mr. C. Waterhall (Bristol) said Mr. Moncrieff's figures showed irregularities which were not easily explained, and his original sewage was of a weak and easily broken-up character.

The great value of the paper was not so much the results obtained under the named conditions, but that it gave a method of ascertaining and stating in figures the results of the highly complicated processes going on in the hydrolizing tank.

Mr. S. G. Rogers (Chard) said he would like to know if there were any particular reasons why flint was used in the cultivation tank, and the size of flint used.

Mr. James Munce (Belfast) said he was glad to hear the queries put to the author, and would like to ask him in addition how he would deal with a case on the lines of the paper where the ordinary daily flow had on one day an increase of 25 per cent. in volume owing to discharge from a distillery, then a period of from one week to three in which no such discharge occurred: on another occasion, also, intermittent discharges from flax washing or other mill and finishing works refuse containing large quantities of chloride of lime; at another time, sea-water lifted for condensing purposes and discharged when considered too foul or too hot for its purpose, or refuse from timber works,

such as creosote, etc.: in short, a sewage which varied from day to day, the same conditions seldom arising, either of volume or quality; and to crown all, with a discharge for the effluent limited to 3½ hours in one tide, *i.e.*, about every 12½ hours?

Mr. E. G. Mawbey (Leicester) agreed with the necessity for preliminary experiments. He had undertaken these at Leicester, the result being that instead of putting down tank capacity for a twenty-four hours' flow, he had found that provision for a quarter of the dry-weather flow was sufficient. The result had been eminently satisfactory. When they tried the twenty-four hours' flow the anaërobic action was far too advanced to give good results, especially when they had to apply the effluent to grass land. What had been attained at Leicester only showed that every district must be dealt with according to its conditions. They had a fair length of outfall sewer, and they had to pump the sewage through 1½ miles of rising main, and he did not require to tell them of the breaking up and splendid preliminary work which was going on before it went into the tanks.

Mr. G. William Lacey (Oswestry) said he had a recollection of Mr. Scott-Moncrieff stating in a paper he read some time ago that he had solved the problem of sewage treatment, but those experiments go to prove, and no doubt Mr. Scott-Moncrieff will himself admit, that the solution has not yet been reached. As he stated generalisation on the subject was not possible, for what treatment would suit one sewage would probably not suit another. He, therefore, could not see that the results obtained were of much use except perhaps in one instance, and that was to show the inadvisability of over hydrolizing or over septicizing of the sewage. He would like to ask what purification, if it were known, was effected by the cultivation tank? What was the analysis of the crude sewage as compared with that of the effluent from the tank? He did not know if Mr. Scott-Moncrieff could explain the variability of the results of his experiments. On working out the percentages of purification effected, the results did not appear to be very good. In albuminoid ammonia, generally speaking, was obtained the greater and the more uniform percentage, it ranging from 77 per cent. to 55 per cent., whereas in oxygen absorbed ranged from 87·5 per cent. in experiment No. 1 to nil in experiment No. 4, this latter being the one on which the hydrolysis was continued for forty-seven hours.

Mr. R. W. Cass (Farnham) said that the results of the experiments treated upon in Mr. Scott-Moncrieff's paper were undoubtedly of interest in so far as they related to the sewage experimented with, but he failed to see how the data could be applied to a scheme involving, say, miles of sewers, with a very slow

rate of flow, in which some of the sewage taken into the sewers very remote from the works, would have undergone considerable fermentation before reaching the same, whilst sewage taken in nearer the outfall may be comparatively fresh, and more nearly approximating in condition to that experimented on by the author of the paper. Furthermore, it would be very difficult to experiment with town sewage under the varying range of conditions which greatly affects its state on reaching the outfall works.

The range between these various states of the sewage was very wide owing to the varying conditions of the sewers, the state of the weather, difference in temperature, the inflow of trade refuse, the time of day or night, and other causes.

He mentioned those matters to show that experiments might be misleading, and also what useful experiments would involve.

MR. SCOTT-MONCRIEFF (Surrey) said that he greatly appreciated the kind way in which his paper had been received. Mr. Martin had truly stated how misleading it was to argue from one case to another. Apparently small differences often make all the difference as regards results.

In sewage treatment there should be no such thing as an unproved expectation. It did not matter what a scheme might be, it was always based upon certain expectations coming from definite proposals, and these should always be tested beforehand and identified with the measured conditions that produced definite results.

The author's case had been stated with the greatest clearness when it was said that we should be able to go to the outfall of a town sewer before the works were constructed and, by means of a suitable apparatus, be able to produce a sample effluent such as could be expected when the maximum number of inhabitants were in residence. The author would add the proviso that in no case should the sanction to borrow for a large scheme be given until a unit of the proposed works had been in operation long enough to make sure that the results corresponded to a previously produced standard sample. If they did not correspond, the causes of the discrepancy should be ascertained before going further. In other words, the contention was that the works should be so designed as to produce a definite pure effluent (previously obtained from accurately measured conditions) from a definite foul sewage.

Not only the ratepayers' money, but many heart burnings on the part of the hard worked inspectors of the Local Government Board, would have been saved if such information had been obtained beforehand. It would give a sense of security to the Board, in their capacity of guardians of the ratepayers' money, if the engineer of a scheme could produce a bottle of effluent which he had obtained from accurately measured, definite conditions, and be able to give an assurance that it would be reproduced on a large scale when the works were completed.

For an example of that, they had only to go to Staines and see how the ratepayers had been protected by having known beforehand,—so much so, indeed, that they did not trouble the Local Government Board, but carried out the work on a very reduced scale of cost and with a clear knowledge of what was required. In that case there was a strong brewery sewage to deal with, and the effluent had to be a very good one, as it passed, and had passed for several years, directly into a tributary of the Thames.

Referring to the various points raised in the discussion, the author was afraid that the scope and meaning of his proposals were not yet clearly understood. It was only beginning to be generally recognised that hitherto the sewage problem had been attacked without any kind of standard measurement.

The instrument of measurement should be an apparatus in which the various factors could be modified through a wide range without trouble and at a trifling cost. It should be equally capable of proving what could and what could not be achieved with any particular sewage, and the results should always be identified with the measured conditions which produced them.

In the case referred to by Mr. Munce, it would be just as easy to obtain an effluent under the conditions prevailing at Belfast as anywhere else, and whatever the proposals for dealing with the sewage might be, they could be tested beforehand, and the cost of a complete scheme calculated from the data obtained. It was no use attempting to measure the length of a road by means of a standard that had never been fixed. In the case of sewage, there had been no common standard of any kind, and different experiences under those conditions could never be properly co-related. The apparatus he had used in those experiments was purely practical, and did not deal with any theories beyond showing their results in the light of the measured conditions which produced them.

Replying to Mr. Rogers, flints were used only because they were the least expensive material available, and an average gauge of about four inches is a suitable size for cultivation tanks.

For practical purposes he considered that in the case of normal sewage the chlorine was as good as any other estimate for strength.

Mr. H. Percy Boulnois also took part in the discussion.

COMPARISON OF HOME AND COLONIAL EXPERIENCE OF MUNICIPAL ENGINEERS.

By R. O. WYNNE-ROBERTS, M.Inst.C.E.

(FELLOW.)

THE author's attention has from time to time been drawn to the somewhat ambiguous notions which prevail in some quarters with regard to the work done, and the experience gained, by municipal engineers in the colonies, so that he felt it desirable to make some comparisons, more especially with a view to affording information to the young engineer, who may feel inclined to seek his fortune in the colonies, and also to those who may be desirous of securing appointments under the various municipalities in new countries.

The author having spent over eight years, first as city and water engineer, and afterwards as water engineer of Capetown, must necessarily give expression to views developed whilst holding the above offices, and after visiting nearly all the leading towns in South Africa and conferring with the municipal engineers employed there.

It must nevertheless be admitted that the experience gained at the metropolis of and the gateway to South Africa, applies generally with equal force to other parts, and very probably to other colonies, especially those south of the equator.

It is desirable that it should be stated at the commencement, that municipal engineers in the colonies carry out practically similar duties to those in Great Britain, although the conditions differ somewhat: much of the public works are on the same lines, and according to the same ideas as prevail in this country. The engineer is called upon to advise, design, and carry out such works, much in the same manner as with British municipalities. And the attitude of the authorities in the colonies towards their officials is also very similar.

British municipalities, however, have had a considerable period for development, although during the last twenty years or so the progress has been more rapid, due largely to the spread of education, to the enormous development of various industries, to growth of towns, and to the ever-increasing requirements imposed by the numerous public health enactments.

In the colonies, however, although some towns have a comparatively long history, the many vicissitudes of fortune, the healthy climate, the dry atmosphere, and the character of the people, have tended to delay many necessary public health works.

Municipal life, as we know it in this country, is in its infancy: the necessity for many public works has not been pressing or urgent, but during the last ten years, owing to the rapid growth of the population at the principal town, the deficiencies of the past had to be remedied. The provision of water supplies, sewerage works, electric light, tramways, public improvements, paving, etc., have, with small exceptions, been made within recent years, under considerable difficulties and at great cost.

Water Supply.—In this country, engineers are under a debt of gratitude to the rainfall organisation so ably conducted by Dr. Hugh Robert Mill and his predecessors, assisted they as were, and are, by loyal and voluntary supporters for about fifty years, and also to the Meteorological Department for the fund of information collected with reference to the rainfall in various parts of the British Isles.

Engineers are, or can be, furnished with reliable statistics as to the mean precipitation in almost all parts of this country, and even where no rain gauges exist it can be estimated with strikingly close approximation by analogy.

This is not the case in the colonies, for although there are Government Meteorological Departments, the number of observation stations is insignificant compared with the magnitude and diversified nature of the country. This is, of course, due to the want of funds and absence of observers. As might be expected, most of the gauges are located near the residences of the observers: comparatively little information is therefore available as regards the rainfall in some of the mountainous districts, whilst the estimation of rainfall in districts where no gauges are fixed is not so easily and reliably ascertained by analogy.

For instance, the author was directed to report on certain watersheds with the view to obtaining an additional supply of water for Capetown and the suburbs. The principal rain gauge was in a valley some six or more miles away from the principal watershed, and it recorded a mean rainfall of 37 inches, whilst in another valley two miles distant the mean annual rainfall proved to be 58 inches, and the results obtained by erecting a large number of gauges on the watersheds in question pointed to the fact that the mean rainfall actually ranged from 50 inches to over 200 inches, according to the positions and altitudes. These were in excess of the most sanguine expectations, even allowing for the different conditions.

Measurements of streams and rivers can be carried out in this country with considerable approximation to the truth during each of the seasons. But what will be said of rivers (such as for instance the Vaal River), which in dry seasons consists of sluggish pools, and can be crossed dry shod without difficulty, but after a few hours rainfall increase in volume, rising sometimes fifty feet, forming a torrential stream many times its bed width.

The author continued the gauging of a stream for three years, the flow of which ranged from about two million gallons to frequently over 2,000 million gallons per day.

The question of evaporation has in this country been fairly well ascertained, as this phenomenon has been observed for many years by various engineers. Evaporation on the water surface of reservoirs and lakes has been found to range from 12 to 20 inches per annum, varying of course according to position, altitude, etc.

In the colonies this forms a very important factor in the engineer's calculations, inasmuch as it varies from 50 to over 100 inches per annum, which necessarily causes a material depletion of the reservoirs' capacities, apart from the ordinary consumption.

The Government of this country has been paternal enough to conduct a comprehensive survey, originally intended for military purposes, and to publish excellent and reliable maps drawn to many scales to suit different requirements. These give the fullest details, are probably superior in many respects to those published in other European countries, and are accepted by the Parliamentary Committees and the Government Departments in connection with any schemes submitted to them. They are also periodically revised, and are purchaseable at low charges.

In the colonies, however, no such maps are available except in certain municipalities and districts, where a large expenditure of money has been incurred in the conduct of surveys and the preparation of necessary plans, such work being generally carried out by the engineers' departments.

Primary triangulation of the sub-continent has been carried out many years ago, secondary triangulation is now in hand, but many years will elapse ere this is completed, after which the tertiary triangulation, topographical and detail surveys will have to be undertaken before the colonial engineer will be in a similar position in this respect to his British *confrère*. When it is borne in mind that the country (British South Africa) measures about 1,200 miles long, by 1,000 miles broad, the amount of work to be executed will be appreciated.

Such maps as are published by the Colonial Governments are com-

pilations of farm plans, with the topography, rivers, etc., shown in a misleading manner. In one water scheme these maps were for a time relied on, until the engineer concerned prepared an independent survey, when the actual area of the watershed was found to be about one-half that shown on the Government map.

It therefore devolves on the engineer to carry out his own surveys, and make his own maps and plans, which often incurs great labour, and entails many difficulties not met with in this country.

Sewerage and Sewage Disposal.—Great Britain may, with propriety, be termed the birthplace of sanitary works, such as sewerage and sewage disposal works, for some of the towns were sewered before and during the famine of 1863, since which time practically every town in this land has carried out more or less comprehensive sewerage schemes. There are, nevertheless, many places where antiquated and ill-designed sewers exist, and which ought, in the interest of public health, to be reconstructed.

In the matter of sewage disposal, the municipal authorities have not been equally successful, for despite the enormous expenditure incurred on heroic schemes and systems, there are, apart from some sewage farms, scarcely any which have continued to give satisfactory effluents, during the past two decades, without material changes in the arrangement or system adopted.

The question of a scientific, satisfactory, and economical disposal or purification of sewage, has been and is receiving the close attention of patient devotees in this country; whilst the engineer has many opportunities of watching and assisting in the development of this important branch of sanitary engineering.

Yet, despite these advantages, the British municipal engineer may with some amount of reason be bewildered by the theories advanced, the methods suggested, the numerous arrangements advocated, the degrees of purification required by different authorities, the elimination of colloidal matters, the separation of storm-water, and finally, the somewhat indefinite requirements of the Local Government Board.

In the colonies sanitary work is, apart from some of the towns, in a rather rudimentary stage. Capetown, Sea Point, Wynberg, Muizenberg, Durban, Bloemfontein, and two or three other towns have carried out sewerage works. Johannesburg is now constructing such works. Port Elizabeth, East London, Pretoria, etc., have schemes ready for execution.

Some sewage disposal works on bacteriological lines have also been constructed.

The scope for the energetic municipal engineer is in this as well as

other directions very considerable in the colonies, for there is a general need for efficient sanitary works. The objectionable pail system is in use at present in most of the towns, and the pails are often inefficiently attended to.

There is of course the ratepayer, who objects to any proposals which mean the expenditure of capital and the payment of increased annual rates. Still, in normal times, this objection is not always so pronounced as to cause the abandonment or delay of necessary works.

The difficulties which have to be overcome in the colonies are chiefly those associated with droughts, floods, and cost.

The mean annual rainfall of a large tract north and west of Capetown is under ten inches, it is in some places as low as two inches, whilst over the remainder of the country it ranges from 30 to 50 inches, and in the years of minimum rainfall these figures are of course much reduced.

The periods of drought extend sometimes over many months, often rendering the water supply very precarious, and materially affecting the efficiency of the sewer flushing.

The number of observations as to the intensity of rainfall in the colonies are not numerous; it is therefore difficult to decide on the quantity of storm-water the sewers should be designed to carry.

The engineers in this country are fairly agreed as to the maximum rainfall for which provision should be made when designing sewers. According to Mr. Maurice Fitzmaurice, $2\frac{1}{2}$ inches of rain fell over London in one day, and in one or two places as much as 3 inches. The heaviest rainfall recorded in the British Isles was 1·8 inches in one hour, and 1·10 inches in fifteen minutes.

The records available in S. Africa show that 4·86 inches fell at Doorfontein, near Johannesburg, in one hour; 3·2 inches fell in fifteen minutes.

Mr. J. Fletcher, Borough Engineer and Surveyor of Durban, has been kind enough to inform the author that the rainfall at Pinetown (near Durban) from 3.0 p.m. on the 31st May to 6.0 a.m. on 1st June, 1905, that is 15 hours, was 15·65 inches, whilst during the twenty-four hours it was 17·65 inches. The heaviest recorded fall was from 9.0 p.m. to midnight on May 31st, when 6 inches fell. The rainfall at Durban was sufficient to put the recording instrument out of action at the Observatory. This storm burst the dam at the Pinetown Waterworks on the Umbilo River, and caused the loss of many lives.

The author had a number of automatic recording rain gauges in use at Capetown, but unfortunately he has no records at hand. He is, however, able to state that during three years the maximum rainfall in

the city has on five occasions exceeded 2 inches in twenty-four hours.

The author also found in an adjoining valley, during the years 1905 and 1906, that a rainfall of 7 inches per day occurred on three or more occasions, and a steady downpour of 1 inch per hour for five hours was recorded.

Such abnormal rainfalls not only affect the drainage and water engineers, but also those connected with railways, roads, and irrigation, and although even when ample culvert capacities and overflows are provided the floods often cause great damage.

The question of cost of works is an important one, as almost the whole of the material has to be imported and an abundant stock kept in hand. Reinforced concrete drain pipes of local make are used at Durban and Johannesburg. Wages are high, as is also the cost of supervision.

Street Work.—Engineers in this country have had a long experience in the art or science of road-making, for since the days of Telford and Macadam great improvements have been effected, although the recent development of the motor cars, etc., call for some changes in the method of construction and maintenance. Good macadam is obtainable at economical rates, and excellent setts can be had locally or by importation. Wood-paving with timber of various kinds, native and treated, and asphalt pavements have been employed for many years.

The British workmen are by long experience thoroughly acquainted with the work of road maintenance, and the moist climate assists to bind the macadamised roads, and to prevent undue warping of wood-pavements.

In the colonies, however, outside the leading towns, and apart from the main roads, road-making is somewhat primitive in character, although it must not be forgotten that the mileage of roads is enormous in the country districts, and the traffic comparatively small. Many of the principal roads, extending for hundreds of miles across the colonies in different directions, were made during the last sixty years; some are in very rough narrow mountain passes, others are across wild driftsand veldts. The difficulties were effectually surmounted, and the work was one of great skill reflecting credit on the engineers. Good macadam is often difficult to obtain except at excessive rates; laterite or ironstone gravel is therefore largely used in country districts, crushed rock from the gold mines at Johannesburg, and river *débris* at Beaufort West, although near this place there are mountains capped with dolerite at hand.

In the progressive towns the engineers have the latest type of steam rollers, scarifiers, and motor vans.

Street scavenging is a daily duty in the towns, but in the villages, etc., it is attended to in a more or less erratic manner. House refuse is collected daily; householders provide suitable pails or other vessels and place the same at the back door. Covered carts are employed in its removal.

Street paving has been carried out in a limited measure. Capetown can boast of one street half-a-mile long, 120 feet wide, paved with local granite setts on a substantial concrete foundation, and also many miles of modern cobble stone paving; the last is necessary to prevent erosion caused by floods, ordinary sett paving being far too expensive. Wood paving with creosoted soft wood is now being laid in the principal streets, and compressed asphalt has been tried on a small scale.

The buckling of wood pavement in wet weather, and the warping in dry seasons, as well as the best means of obviating the same in subtropical climates, are matters which occupy the attention of the municipal engineer.

A little paving working has been done at Johannesburg and Durban. The footways are either tar-paved, laid with concrete slabs, compressed asphalt, or made of gravel. At Capetown gravel footways have all but disappeared.

The climate is very trying, as in the long dry hot seasons the road surface disintegrates unless abundantly watered; in the wet seasons it is frequently seriously eroded by torrential rains.

Trenching of streets for various purposes adds materially to the difficulties which the engineer has to contend with, although even in some British towns this question is still being discussed, without much tangible improvement being affected.

Refuse Disposal.—The experience gained by engineers in this country in the cremation of house and other refuse is very considerable.

Domestic refuse contains a quantity of carbon, which facilitates cremation without the addition of fuel.

Destructors of many types have been installed, and great improvements have been effected, a large quantity of surplus heat being utilised to generate steam power for various purposes. Other methods of disposal also are in vogue.

In the colonies domestic refuse contains but little carbon in the form of ashes and coal waste, as coal is expensive, and the warm climate renders heating unnecessary except for a few days in the year. Gas fires and stoves are largely used for cooking purposes, and also wood with little coal.

Vegetable matter predominates to a greater extent than in these

temperate countries, and as the calorific value of such refuse is low, fuel has to be added. There are a few refuse destructors installed, but no official returns are available as to their efficiency.

Surveys.—As the author has already stated, the municipal and, indeed, any engineer in this country has very limited scope for surveying. Trigonometrical and especially tacheometrical work rarely comes in his way.

In the colonies he soon finds out that the antiquated methods in vogue in most places in Great Britain have to be abandoned for newer, more scientific, and expeditious systems.

Young engineers from European countries, such as Denmark, Sweden, Germany, and Italy, are generally proficient in the art of surveying, and in the employment of instruments rarely used or seen in this country, consequently young British engineers are at a serious disadvantage in this respect. The tacheometer, for instance, has been used on the Continent with great success for over fifty years, yet such an instrument is not often met with in the British engineer's office.

The art of surveying is probably as fully developed in the colonies as in any other part of the world. There the best system available supplants the traditional methods, for the engineer is not hampered by ancient precedents, and new departures are adopted without hesitation, provided the advantages are fruitful in the direction of accuracy and expedition. The chain or tape is seldom used except on small surveys, or in establishing the base line.

The difficulties to be surmounted are many; such as rugged grounds, steep mountain slopes, ravines, wide rivers, and great distances.

The author has carried out extensive levelling with dumpy levels fitted with stadia lines, thus obviating the employment of a chain or tape, and the results were satisfactory and expeditious.

He has also made contour surveys of about 4,000 acres of reservoir basins by means of the tacheometer, the dumpy level being used only to obtain a longitudinal section, and to fix a few datum points as a check. By this system he was able to obtain the bearings and spot levels at the same operation. Contour lines five feet or less apart were drawn, and the capacities of proposed reservoirs were obtained with equal, or possibly greater accuracy, greater expedition, and at less cost, than would be obtained by the usual home methods.

Surveying in the colonies is done under stringent laws when applied to fixing boundaries or the transfer of land.

In Great Britain the boundaries, areas, and ownership of properties are not satisfactorily defined or established, except probably in the metro-

politan area and a few other places. Very few titles have been registered, and the difficulty sometimes experienced by engineers in demarcating estate boundaries is not small, but in the colonies such information is available on the payment of a small fee for searches. Boundaries and areas are shown on diagrams prepared by licensed surveyors, who have to qualify by passing a Government examination. Ownership of properties can be ascertained, and the history of any patch of land can be traced back to the original grant.

The author was thus able to know the dates of transfer, the amount paid for the property, the position of beacons (the removal of which is a penal offence), and to trace back the history of many farms over one hundred years, without much difficulty or delay.

Staff and workmen.—In this country a trained staff of assistants and workmen is generally found without trouble by almost every municipal engineer, and as the work is steady, with prospect of advancement, changes are therefore comparatively infrequent. Contractors equipped with modern appliances and provided with efficient assistance are to be found to undertake the construction of public works and to give satisfaction. There are of course exceptions in this.

In the colonies the engineer, as a rule, finds it not so easy to obtain municipally trained and qualified assistants. Competent engineers are certainly to be had, but often lacking municipal experience, and they have therefore to be trained to this varied class of work. In normal times of prosperity the opportunity for advancement in other districts causes frequent changes in the *personnel* of the staff; especially is this the case at the metropolis. Engineers, however, soon adapt themselves to the particular requirements, and their work is satisfactorily executed.

The engineers at the leading towns have to design artisan dwellings, native locations, electric light stations, waterworks, street improvements, and other works too numerous to mention, some of which never develop beyond the paper stage; yet the variety of schemes designed and executed are as great as, and in some instances greater and more difficult than in this country.

The office and outdoor organisation are in some places equal to any British prototypes. Buildings and drains are carefully inspected so as to ensure conformity with the bye-laws, development of estates are controlled, and street and building lines defined. Correspondence, plans, and records are preserved, and registered by card indices.

Stores which are imported are carefully recorded, six months' stock being usually kept in hand.

Stabling for 200 horses and mules, with lifts for forage; yards for carts and wagons; workshops fully equipped with machinery for construction and repairs; departmental roadmaking, scavenging, and construction of many public works, were established during the author's occupation of office.

The staff of superintendents, foremen, etc., were also instructed in their duties. The workmen employed in the colonies are chiefly natives and Indians, who require greater supervision than British workmen, and are necessarily less proficient in their work.

Generally.—One of the advantages derived by engineers in the old country is the frequent meetings with their *confrères*, where matters of common interests are discussed and the benefit of mutual intercourse is gained. Travelling is easy, distances are small, the cost moderate, and meetings are therefore frequent. Works of different kinds are visited, criticised, and compared.

Members of British Municipal Councils who have held office for long periods are often to be met with, and it may be claimed that they are consequently better able to judge of the local requirements and are more conversant with the routine work, whilst continuity of policy is more or less assured by such lengthy service. On the other hand, long services of councillors and continuity of some policies may sometimes be said to be detrimental to the interest of the communities concerned, so that the retirement of some old members who have become fossilised in their ideas and the substitution of fresh blood might be beneficial, for occasionally long service engenders conservatism, and the election of new members spells progress.

Another feature of British municipalities is the steady development of sanitary and other works from year to year, although this may not be an universal rule.

In the colonies there are no such frequent meetings of municipal engineers, but there are, however, societies of engineers where municipal subjects are sometimes discussed. The distances between the principal towns are great, and the cost of travelling correspondingly expensive. The municipal engineers have consequently very few opportunities of rubbing shoulder with each other, and of discussing subjects of mutual interest.

Councillors in many places have, as a rule, short records of service; for instance, at Capetown, at the end of ten years, only one councillor of the original eighteen remained in office. This has a disturbing effect on the general policy, for schemes are advocated one year, for which elaborate plans and details are prepared, but when some new members are returned at

the next election who have criticisms to offer on the work of their predecessors, the policy is then changed and the scheme suspended or dropped. This is, of course, not peculiar to the colonies.

The growth of towns is unsteady, during some periods it has been abnormal, then stagnation follows. On the one hand works are undertaken with considerable enthusiasm and confidence, whilst on the other economy, etc., is the order of the day. The engineers, therefore, find it difficult to design works to meet such fluctuating contingencies and to comply with the future requirements with due regard to efficiency and economy.

New estates are suddenly developed, new streets are required, with no definite indications as to the future extensions. Sewers, water-mains, gas-mains, electric light cables, and tramways are laid, but the absence of the essential particulars as to comprehensive future developments often renders the engineer's work somewhat perplexing, as he must design for the future as for the present needs of the localities.

In the old country the young engineer is, in a measure, guided by the successful work already executed in various parts, adapting the design to the special requirements in view; but in the colonies he is thrown on his own resources and ingenuity, relying on his training, knowledge, and personal grit.

In the old country the engineer can consult with his *confrères*, but abroad he must strike out for himself, with no one at his elbow to offer assistance.

In the old country the engineer is inclined to be somewhat conservative in his ways: for instance, reinforced concrete is still looked upon by some with an obliquity of vision and doubt, although our Continental friends have employed it for over a generation. Any departure from old-established rules and formula is regarded as doubtful wisdom, and many young engineers are often held back in their progress owing to the lack of opportunities.

In the new countries the engineer will find that the field for development is large, and he has many opportunities of exhibiting his stamina, value, power, and independence, an excellent school to cultivate the qualities of self-confidence and tact, as well as *bon amité* towards those with whom he may work.

In conclusion, the author submits the following statistics so as to afford some idea of the magnitude and varied character of the municipal works undertaken during the last ten years at Capetown and Durban. These are sufficiently accurate to indicate the strides which have been

made in such a short period, and are typical of what has been done at Johannesburg, Bloemfontein, Wynberg, and other places to which reference could be made did space and time permit.

The capital expenditure incurred during ten years 1897-1907 was approximately as under:—

Capetown.—Street Improvements	...	£828,000
Sewerage and Drainage	...	670,000
Markets	...	60,000
City Hall	...	205,000
Hospital	...	50,000
Fire Brigade ...	...	30,000
Waterworks	...	537,000
Electric Light Works	...	280,000

These do not include the whole of the works undertaken, such as Stores, Athletic Grounds, Gardens, Stables, Workshops, etc.

Durban.—The author is obliged to Mr. J. Fletcher, the Borough Engineer, for the following figures for the last ten years:—

Waterworks	...	£291,483
Electric Light Works	...	228,699
Sewerage	...	193,330
Bay Embankment ...	...	65,840
Storm-water Drainage	...	141,679
Electric Tramways ...	...	401,797
Telephones	...	93,261
Baths and Market ...	...	40,000
Town Hall now being built.		

The debt per head at Capetown is about £34 and Durban £35. Rateable value at Capetown, £15,218,000; Durban, £10,228,000.

Mr. Luke M. Hill (British Guiana), as a colonial municipal engineer of thirty years standing, expressed his appreciation of Mr. Wynne-Roberts' paper in pointing out the difficulties experienced by engineers in the colonies in endeavouring to carry out works of improvement. Proceeding to explain certain local conditions pertaining to his own particular colony, Mr. Hill pointed out that the general surface level of the city of Georgetown was 4½ ft. under high-tide level, and the sea had therefore to be kept out by sea walls and clay embankments, and the drainage effected by a system of inter-tidal sluices worked in connection with large drainage canals and trenches. In road making,

owing to the heavy cost of granite macadam, which had to be quarried some hundred miles in the interior, recourse had frequently to be had to burnt clay, the clinkers being broken down to the size of ordinary macadam and covered over with shell obtained from numerous shifting shell banks along the coast line. This method provided an excellent smooth surfaced road suitable for light vehicular traffic, and the results were even better when the shell was mixed with the clay and burnt *en masse* with it, yielding a product approaching the composition of a crude portland cement.

MR. H. PERCY BOULNOIS and MR. EDWIN T. HALL also took part in the discussion.

SURFACE TREATMENT OF ROADS WITH REFERENCE TO DUST LAYING.

By REGINALD BROWN, A.M.Inst.C.E., F.S.I.,
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(MEMBER.)

THE evil effects of road dust are conceded on all sides, the inhalation of the mineral or inorganic dust arising from the wear of the material constituting the roadways has a cumulative effect, and must in course of time subject the inhalers to the dreaded phthisis and other lung and throat complaints. Again, the organic matter arising from animal traffic is sufficient to cause uneasiness in these days of mixed traffic. It may be taken that there are two sources of dust, the material of which the road is constructed and the material deposited on the road from outside sources, not only from animal sources, but also the mineral and organic matter blown upon the roadway, especially in the country, from the open fields skirting the main arteries of traffic. In passing, it might be mentioned that the suggestion of cutting the hedges, for another object in view, would remove a chief protection to the roadway from dust arising from the fields, and it would appear that the remedy would be worse than the disease: some other method must be devised for the protection of the traffic, and this method must be adopted by motorists themselves, viz., more care in driving.

Can the two main sources from which dust is produced be tackled, and the creation of dust prevented?

So far as the dust arising from the material used for road construction is concerned a percentage is caused by atmospheric influences, but the larger proportion by horse traffic, and it is obvious that the denser the road material the less the dust, hence it follows that to eliminate the dust created from the road material itself only good material should be used. A dustless road means a mudless road, and when it is considered that 1lb. of dried dust becomes approximately 7lbs. of mud, it is an axiom of economy that roads should be kept free from dust *as far as possible*. One does not wish to dwell upon the various materials used in the con-

struction of roads as this is hardly the place for such a question to be considered, suffice it to say that many of the *paved* roads in existence would prevent the dust from the cause first mentioned.

As to the second cause of dust, animal traffic, this is a much more important matter from a sanitary point of view, as the dust is filth largely composed of horse droppings, attacking the mucous membranes of the throat and nose, and possibly the lungs; settling on our food and rendering it highly dangerous. It causes sore throats, nasal catarrh, pneumonia, and other diseases of the respiratory organs and passages. Freedom from dust would conduce to health and to a low death rate. The dust from the streets is made up of more ingredients than is thought of by the man in the street, such as horse droppings, excreta from dogs, cats, cattle, sheep, etc., from human expectorations, and from sweepings from forecourts.

The inhabitants of towns should be prevented from depositing sweepings in the public thoroughfares, the filthy habit of spitting should be punishable by a fine; but what about the excreta from animals? Is it too much to suggest that owners of dogs and cats should pay an increased license, to be spent locally, to cover the cost of removing the excreta from their pets? The effect would probably be the elimination of a great number of cats and dogs, a result much to be desired. As to the removal of excreta from horses, sheep and cattle, is it too much to expect a by-law prohibiting the leaving of such excreta on the roadways and footways of our towns and villages? At present it is compulsory for any person carting manure and such like matter to remove any droppings, and why cannot some such provision be made in the case of droppings from animals? We might then see some arrangement made for the prevention in some cases of such a cause of road dust. Until this time arrives constant and efficient scavenging can only modify the cause, but the cost in all except urban districts would be prohibitive. To obtain perfection *all* must assist.

The majority of the roads throughout the urban and rural districts are constructed with surfacings of broken granite, flint or local gravel of varying strengths, and unless some substantial assistance is rendered from the Imperial exchequer to local authorities for the strengthening of road foundations, very little can be done as the local rates, in many instances, are high enough; the money for such improvements could be obtained by a tax on *all* road users, or in other words those for whom the roads are constructed and maintained.

For the present we have to deal with roads as they are, and not with roads which might exist under more favourable conditions.

It must not be forgotten that a good many County Councils and other bodies have spent and are spending large sums of money on tar-macadamising roads, and although this method is a step in the right direction, still the want of money prevents the application extensively.

The chief object of this paper is, however, to refer to the methods of treating existing road surfaces for the prevention of dust, and not to reconstruction of roads.

The methods of treating surface of roads are watering, tar-painting, oil-tarring, and treating with akonia, calcium chloride, halmite, pulvicide, and other materials.

1. *Watering.*—This not only lays the dust (if only for a short time) but also washes the road: water, as a rule, is cheap; it is cooling, and leaves no odour, but it makes mud and causes the surface of the road to be sloppy. The cost of watering per square yard per annum may be taken at 1d., and this for a mile of road eight yards wide would represent £58 13s. 4d. per mile per annum.

2. *Tar Painting.*—Miles of roads have been tarred during the last few years in various parts of the country, and the results attained are pretty well known. From some we hear good reports, whilst from others the reverse is the case; the author thinks that the results depend considerably upon the time and method of application, and also on the nature of the subsoil of the road. In some cases it has been noted that where the subsoil is clay or other impervious formation the results have been unsatisfactory, whilst where a pervious subsoil exists the result has been favourable. This might give rise to a very interesting discussion.

Tar has been applied to roads both by hand and by machinery, and in a hot and cold condition. It is generally accepted that coal tar should be applied hot, and, if possible, the material should be applied by hand in preference to machine, as better results can be obtained, but as the work would progress too slowly an efficient machine is desirable. Hand-painting provides for a comparatively *thin* coating of tar which is preferable to the thick coating obtained by machinery, and is equally effective in preventing water from penetrating into the road. In all cases, however, the treated surface has to be covered with fine grit.

The cost of treating roads by tar-painting may be taken as an average to be 1½d. per square yard, but will, of course, vary according to the cost of material and labour: at this rate per square yard the cost per mile, for a road eight yards wide, would be £88 per annum.

Some fear has been expressed that if the treatment of roads by tar painting was generally adopted there would be insufficient tar to meet all

requirements. To ascertain the truth in the matter the author has worked out the amount of tar produced in England and Wales from published records of the coal gas production of the country and finds the total to be approximately 164 million gallons. If each square yard of

COAL-TAR.

Bedfordshire	638,000	Leicestershire	2,477,000
Berkshire	920,000	Lincolnshire	1,385,000
Breconshire	38,000	Merionethshire ...	35,000
Buckinghamshire ...	291,000	Middlesex	49,791,000
Cambridgeshire ...	536,000	Montgomeryshire ...	40,000
Cardiganshire	55,000	Monmouthshire ...	794,000
Carmarthenshire ...	101,000	Norfolk	892,000
Carnavonshire... ...	207,000	Northamptonshire ...	1,368,000
Cheshire	3,671,000	Northumberland ...	4,371,000
Cornwall	289,000	Nottinghamshire ...	2,492,000
Cumberland	652,000	Oxfordshire	520,000
Denbighshire	293,000	Pembroke	97,000
Derbyshire	923,000	Radnorshire	10,000
Devonshire	2,400,000	Rutlandshire	29,000
Dorsetshire	338,000	Shropshire	497,000
Durham	3,257,000	Somersetshire	1,376,000
Essex	1,478,000	Staffordshire	4,575,000
Flint	110,000	Suffolk...	804,000
Glamorganshire ...	2,571,000	Surrey	3,764,000
Gloucestershire ...	3,792,000	Sussex	2,840,000
Hampshire	3,694,000	Warwickshire	8,566,000
Herefordshire	201,000	Westmoreland... ...	138,000
Hertfordshire	938,000	Wiltshire	614,000
Huntingdonshire ...	57,000	Worcestershire ...	1,317,000
Kent	4,217,000	Yorkshire	18,798,000
Lancashire	24,555,000		163,812,000

Say 164,000,000 gallons.

roadway required an average of one-eighth of a gallon the mileage of roads, calculated at eight yards wide, would represent over 93,000. This would be more than sufficient. Moreover, tar is produced at other works besides gas works.

For the information of those interested in the matter the author has

attached tables showing the distribution of coal-tar throughout the country (see preceding page).

3. *Oil-Tar.*—Oil-tar is the bye-product of the manufacture of gas from oil, and varies in its composition according to the temperature of production, the nature of the retort or producing-plant and the nature of the oil used. It is of an extremely complex nature. A very much smaller quantity of oil-tar is produced in the country than of coal-tar, and it is owing to the smaller production and the want of uniformity in the nature of the product that oil-tar has not been studied to nearly the same extent as coal-tar, and there has been even some doubt as to what the chief constituents are. Whilst the bulk of coal-tar finds its way into the distiller's hands, oil-tar is generally employed as fuel. The author is particularly interested in this material, as he has used it *largely* for the past two years, and, so far as he knows, his district stands alone: oil-tar being applied to *all* the streets, water-carts have been abandoned.

Oil-tar, as generally obtained, is very little used by distillers owing to the large amount of water it contains (something like 75 per cent.), but where the material is required for fuel the water is eliminated as far as possible, and one is able to obtain a liquid containing only a small percentage of water.

Below is an essay of a sample of oil-tar:—

		Final temperature of Resultate.	Percentage.
Water ...	... ...		2·0
1st Runnings	Naptha, Benzol, &c.	110° C.	8·0
2nd „	Green oil (white paste when cold) ...	210° C.	23·2
3rd „	Heavy oils (fluid amber)	240° C.	20·0
	Carbolic oils and creosote, &c. ...	268° C.	
4th „	Yellow paste when cold (impure anthracene)	350° C.	5·6
5th „	Anthracene oils	400° C.	21·0
	Residue pitch		20·2
			100·0

A considerable quantity of oil-tar containing 50–60 per cent. pitch is produced every year, and for record a table is attached showing the production and distribution.

From extended experiments it has been found that 4 dressings are required for each watering season, and that on an average one gallon will cover 10 yards square, the production would therefore surface some 2,618 miles of road taking the width as 8 yards.

The cost of surfacing roads with oil-tar averages 1d. for 4 dressings, no grit being required for covering, and this works out at £58 13s. 4d. per mile per watering season.

In some instances the material is applied hot, but the author uses cold and is well satisfied with its use and results. It is applied by means of an ordinary watering cart, manual labour being utilized to rub it in the road. The appearance of a road treated with oil-tar is that of a newly laid wood pavement (creosoted deal) and has a similar odour. The material being of about the same density as water sinks into the road readily, and the author from frequent tests finds the penetration to be as much as 2 in.

Oil-Tar.

Berkshire	145,000	Middlesex	4,997,000
Buckinghamshire ...	15,000	Monmouthshire ...	50,000
Cheshire	467,000	Northumberland ...	180,000
Cornwall	35,000	Norfolk	130,000
Cumberland	60,000	Somersetshire	242,000
Devonshire	380,000	Staffordshire	210,000
Durham	145,000	Suffolk	75,000
Essex	195,000	Surrey	611,000
Glamorganshire ...	230,000	Sussex	615,000
Hampshire	435,000	Warwickshire	1,532,000
Hertfordshire	120,000	Wiltshire	94,000
Kent	620,000	Worcestershire ...	30,000
Lancashire	2,610,000	Yorkshire	945,000
Leicestershire	340,000		
Lincolnshire	80,000		15,588,000

Say 15,588,000 gallons.

As some doubt might arise from a health point of view, the medical officer of health for Southall-Norwood reported in 1906, as follows:—"The treatment with waste oil (oil-tar) with a view to keeping down dust has, in my opinion, been effective, and I think there can be no doubt that the experiment justifies further trial. I believe if the roads throughout the district were so treated it would minimise the incidence of certain illnesses in the summer. Those competent to speak on the matter assert that a large part of the diarrhœal and sore-throat illness during summer is due to microbial infection conveyed from dusty roads. In one or two towns the experiment has been made of treating the road-surfaces, with

some dust-laying substance, of certain streets in which the incidence of these complaints had been greatest, and the result was a marked decline in the sickness rates of these complaints in the particular area so treated compared with those not treated. If I understand the question rightly, the council desire me more especially to say how far the binding down of manure, etc., with this material, and its subsequent diffusion of dust, is likely to increase rather than reduce the risks of manurial dusts, than if the roads were kept constantly swept without this treatment. I can only say that the substance used is an antiseptic of the coal-tar series, and as such would destroy the living organisms in manure long before their disposal as dust could ensue."

This is an important statement from a health point of view, and in addition to this the use of some such treatment tends to diminish the noise from traffic and preserves the surface of the road from wear in a remarkable manner. In many cases roads having to be coated yearly under the old system of watering only require coating once in two years when oil-tar is used. Of course, the same results would accrue from the use of coal-tar, and it is the author's opinion that the use of both will, in many instances, become pretty general, the use of oil-tar where it can be obtained, and the use of coal-tar where oil-tar is not manufactured.

4. *Akonia.*—This material has a very good report from many sources. It is said to preserve and improve the roads, diminishes the dust and mud, does not affect bicycle tyres, etc., and is odourless. It is applied by means of the ordinary water cart.

For the first dressing a full-strength solution is used by dissolving one ton of akonia in about 800 gallons of water, subsequent dressing (quarter-strength solution) at intervals of ten days. The cost of this treatment is said to be ⅜d. per square yard per dressing, and for three full-strength dressings the cost per mile of eight yards wide would be £66.

5. *Calcium Chloride.*—The success of this material depends upon its power of absorbing moisture from the atmosphere. The calcium chloride should be dissolved in a separate tank and kept in a strong stock solution, from which the water-carts can be charged. The material is supplied by means of the ordinary water-cart and what happens after application is simply that the water in which the calcium chloride is dissolved, dries off just as ordinary water does, but the calcium chloride itself remains: it continually attracts to itself moisture from the air, and so keeps the road surface slightly moist.

Certain objections have been raised to this material as to its effect on the roads and also to the boots of the men laying the material.

The cost of this treatment is about $\frac{3}{8}$d. per square yard, and for a mile, eight yards wide, the cost would be £66.

6. *Hahnite.*—This consists of a mixture of oil and water. It is applied by means of the ordinary water cart, fitted with an agitator, the cost with necessary gear and fixing being £12. The cost of hahnite is £7 per ton, and the makers claim that $5\frac{1}{2}$ tons will treat a mile of road during the season of six months, using on the first application a 25% solution, and three subsequent applications of $12\frac{1}{2}$% solution. The makers claim that the treatment is under a 1d. per yard super. for the period of 6 months, and at this rate represents a cost of £58 13s. 4d. per mile of 8 yards wide.

7. *Pulvicide* is a patented compound, but licences are granted by the patentees for its manufacture. It appears to be a mixture of pitch, resin, and other materials. It is said to be a road binder, but objections have been raised as to its dark appearance and that it becomes slippery. Its cost may be calculated at £61 11s. 8d. per mile of 8 yards wide, with ten applications.

COALESINE FUEL: UTILISATION OF HOUSE REFUSE.

By HERBERT G. COALES, Assoc.M.Inst.C.E., F.S.I.,
Town Surveyor, Market Harborough.
(MEMBER.)

IN an address given at the annual meeting of Associates of The Royal Sanitary Institute, Mr. H. Percy Boulnois, M.Inst.C.E., made a rough estimate of the amount of refuse produced by the seven and a quarter millions of Greater London. He said "A year's collection would mean a heap of refuse sixty feet high, filling from house to house about fifty miles of streets." It is evident, therefore, that the disposal of refuse is a very big question, as well as very important from a sanitarian's point of view.

House refuse in the interests of health and general convenience must be removed from the premises as speedily as possible. The Public Health Act, 1875, refers to such refuse removal "from the premises" as if that settled everything, much as the queen in "Alice in Wonderland" cried "off with her head." Provision should be made, however, for the sanitary disposal of the refuse, and not for dumping it down on other premises, which, as defined under the Public Health Acts, include "messuages lands and hereditaments of any tenure."

Refuse Tipping.

It seems most probable and reasonable that a prohibition will be enacted in the near future against tipping crude ashes into holes and low lying places adjoining a town. Such an enactment is overdue, and it is, indeed, somewhat like thrashing a dead horse to emphasize the point; but so long as underground water is fouled, the atmosphere vitiated, and disease germs produced, so long must sanitarians call attention to the nuisance, and they must point out the remedy. Dr. Hamer, Medical Officer of Health to the London County Council, has quite recently warned the community against depositing refuse in the neighbourhood of houses, a practice which engenders the multiplication of house flies, and the consequent spreading of diarrhœa and enteric fever.

Broadly speaking, there are two methods of treating ashbin refuse in a sanitary and reasonable way, destruction by fire and assimilation by the

land. There are methods of disposal which are insanitary and disgusting, in addition to that of refuse tipping; for instance, sea dumping, and sorting refuse by hand for the sale of its various constituents.

1.—DESTRUCTION BY FIRE.

By this system the refuse is treated as a fuel. It is found that the calorific value varies in different towns, and at different seasons, but generally speaking 1 lb. of refuse will evaporate from 1 to 2 lbs. of water. Refuse can adequately be disposed of by burning in refuse destructors, but at the cost of from 1s. 6d. to 3s. per ton, bringing into account all capital charges, interest, wear and tear, labour, &c. Mr. T. W. A. Hayward, A.M.I.C.E., Borough Engineer of Battersea, said in 1906, at a meeting of the Municipal and County Engineers, that "The price per ton for barging the refuse under the present contract is less than the cost of burning. The cost of disposing of the refuse after being placed in the barges is 2s. 10d. per load."

If by the words "utilisation of refuse" is meant the profitable disposal of such refuse, then destruction by fire in refuse destructors *at a loss* is not utilisation.

At first sight it may be contended that if the destruction of refuse in a destructor cannot be done at a profit, that is an end of the matter, and authorities must make up their minds to put the charges on the rates for ever. But happily the question may be tackled in another way with the view to utilising (or making a profit of) the disposal of refuse.

It is evident that, could the great cost of erecting specially constructed furnaces to consume enormous quantities of refuse at one spot be obviated, and the refuse instead be consumed in ordinary boiler furnaces or other grates, then the disposal of refuse would be greatly cheapened. But untidy, ragged, offensive refuse cannot be burned in ordinary boiler furnaces or grates without nuisance. The crude refuse must therefore be converted into an innocuous form before it will be possible or sanitary to bring it for consumption to such boilers. In other words, the refuse must be converted into briquettes, deodorised and made inoffensive.

The author has proposed to destroy refuse in a remunerative manner by converting it into fuel briquettes, called Coalesine, and burning it in boiler furnaces or other grates, without the construction of special furnaces. If such a hygienic and remunerative method of disposal can be demonstrated, then no pecuniary hardship will accrue to any town through any anti-tipping enactment that may be passed. Two main reasons may be indicated for converting ashbin refuse into fuel:—

1. Crude refuse is a nuisance, which may be abated by subjection to fire.
2. Crude refuse is a fuel, which may be utilised in the production of heat.

Pulverisation of Refuse.—The Patent Lightning Crusher Company, of the Southwark Engineering Works, has perfected a machine, known as the dust manipulator, which instantly converts crude ashbin refuse into a material resembling garden mould in appearance. The machine is a high-speed centrifugal-force disintegrator, pulveriser and mixer combined. The hammers, weighing 50 lbs. each, of special alloy steel, are hung on an axle in a steel box; this axle makes 1,000 revolutions a minute. The refuse is fed by shovel into a hopper, and can be passed through the manipulator at the rate of from four to five tons per hour. The Southwark Borough Council have four of these machines at work, and the facility with which they disintegrate tins, old sacking, wood and what not, is most surprising to those who see the machines at work for the first time. Such large articles as old trays or buckets are picked out from the refuse by hand, and any obstinate metal which cannot be reduced by the hammers is automatically ejected from the machine by a door at the front. It has been proposed in the past to pulverise crude refuse in mortar mills, &c., but salmon tins, old garments and books, or pieces of wire, for instance, cannot be reduced to a fine material by such means. Therefore, until the Patent Lightning Crusher Company introduced the manipulator, there was no machine on the market to effectually reduce crude ashbin refuse to a fine uniform consistency, in which state only can it be briquetted.

Coalesine Fuel.—To convert the pulverised material from the manipulator into innocuous, serviceable fuel briquettes, the addition of a deodoriser, an agglutinate, and an enriching ingredient are necessary.

Most fortunately for the simplicity and cheapness of the manufacture of briquettes, tar is both a deodoriser and an agglutinate, as well as a high-class fuel. 1 lb. of tar will evaporate 11 lbs. of water. By the incorporation therefore of about 18 gallons of tar to the ton, the pulverised refuse is deodorised, agglutinated and enriched by one operation. The enrichment has the effect of adding 100 per cent. to the calorific value of poor refuse, and 50 per cent. to refuse of a good calorific value. But fuel in the form of slack does not give the best combustion results, it is necessary therefore to make the material up into briquettes, in which form it is easy to handle, to store, and to burn.

The proportion of 18 gallons of tar to the ton of pulverised material does not allow the tar to escape through the grate bars when subjected to the heat of the fire, nor to give off smoke from the chimney shaft through incomplete combustion.

The approximate cost of plant, including manipulator, mixer, briquette

press, buildings and power, to convert 10,000 tons of ashbin refuse per annum into coalesine fuel is from £2,000 to £2,500; or say capital outlay of from 4s. to 5s. per ton of refuse to be dealt with in one year.

From the tabulated statement prepared by Mr. William Jones, Assoc. M. Inst. C.E., of Colwyn Bay, in October, 1907, it appears that the initial cost of installing refuse destructors complete (taking the average of 69 towns) is 16s. 5d. per ton of refuse to be dealt with in one year.

The approximate cost of converting ashbin refuse into coalesine fuel, including labour, power, tar, wear and tear, and loan charges, is calculated at about 4s. per ton.

Calorific Value of Coalesine Fuel.—When 1 lb. of crude refuse will evaporate 1 lb., 1½ lb., or 2 lbs. of water, coalesine fuel will evaporate 2¼ lbs., 2¾ lbs., or 3¼ lbs., or ·25, ·31, or ·36 the value of best coal taken at 1 lb. evaporating 9 lbs. of water.

Roughly speaking then, coalesine fuel may be taken as having an average calorific value of one-third that of best coal. Where the local price of coal is known, therefore, the relative value of coalesine fuel may easily be found by dividing the price of coal by three, and comparing the result with 4s. a ton (the cost of producing coalesine fuel). For instance, taking coal at 18s. a ton and dividing by three we get 6s., and 6s. less 4s. (cost of coalesine fuel) is 2s., this being the balance in favour of coalesine fuel. Where, however, at present a town is paying 2s. a ton (say) to dispose of its refuse, that town would naturally be 2s. a ton to the good if the coalesine fuel were sold merely to pay for itself.

Coalesine fuel can be burned by itself or in conjunction with coal to suit the varying steam requirements of consumers. It is obvious that the addition of coal in no way detracts from the pecuniary advantages obtained by the use of coalesine fuel, whilst at the same time the hygienic object is equally attained.

ASSIMILATION BY LAND.

The Southwark Borough Council sell the pulverised refuse from their manipulators (in a state of mould) as a fertiliser to the farmers in the country districts around. Heavy land is lightened and made to work better by ploughing in a good dressing of the fertiliser. Many sewage farms, with a preponderating stratum of clay, would greatly benefit and become better filters for sewage if for a few years they were so treated.

The initial cost of a plant complete to convert refuse into a fertiliser is from 2s. to 2s. 6d. per ton of refuse dealt with per annum. That is to say, 10,000 tons per annum could be dealt with by a plant costing from £1,000 to £1,250.

In addition to the small initial expense of installing a manipulator

plant as compared with a refuse destructor, the pecuniary results of the output are two or three times more favourable at Southwark than a refuse destructor would be.

Joint System of Disposal.

It is apparent from the foregoing notes that the fuel or the fertiliser could be turned out by the local authority according to the demand. This fact of having two strings to one's bow would be of great value in dealing with the problem of disposal.

Mr. E. Y. Saunders (Barnstaple) said he had carefully inspected the system of pulverising house refuse as at the Southwark Engineering Works, and felt that there was every probability that this method when better known would be largely adopted, especially by smaller towns, with whom the provision of the conventional type of refuse destructor was a serious item of expenditure, both in capital outlay and annual upkeep and maintenance. Mr. Coales' patent perfected this pulverising system by ensuring that no nuisance or inconvenience need be feared by not being able to dispose of all or any of the crushed refuse for manurial or other purposes on land. He was surprised to find that a mere pulverising process could produce such a transformation in the heterogeneous collection which usually made up house refuse, the crushed product being entirely free from smell, and in appearance strongly resembling fresh garden mould.

Mr. H. G. Coales (Market Harborough) said he had no fear that sufficient tar or pitch would not be available for the new process, as of course he only suggested this scheme as an alternative to other schemes. Every town must consider the requirements of its own particular locality. The point he wished to make was that ashbin refuse could be converted into a fuel, and that such conversion, as well as being a sanitary operation, had a commercial aspect too. It was generally admitted that ashtips were an abomination, and refuse destructors very expensive, both in their first cost and upkeep. As to the calorific value of coalesine fuel, of course one could not get something out of nothing, but there was no doubt that crude ashbin refuse had a heating value of about one-sixth of best coal, and when treated in the new manner the value was increased to one-third. The tests of the briquettes had been made in a Cornish boiler at the Market Harborough Gas Works. He had looked for smoke, but none issued from the chimney, either with or without the forced draught; this he attributed to the fact that there was thorough combustion. The briquette form of the fuel allowed plenty of flame space between the blocks, and so one did not get a smothered fire.

Mr. W. D. Scott-Moncrieff, Mr. Walker Smith, Mr. C. H. Priestley, and Mr. H. Percy Boulnois also took part in the discussion.

TOWN PLANNING.

By WILLIAM HARPUR, M.Inst.C.E., F.S.I.,
City Engineer and Surveyor, Cardiff.
(FELLOW.)

THIS question is one to which attention has of recent years been called by public men and local authorities, and as a result of the bad examples of town planning to be found in every populated part of the country, resulting in narrow streets, courts, alleys, congested and insanitary areas, Parliament is now attempting to put right what should have been done at the latest through the medium of the Public Health Act, 1875.

The probable cause of a good deal of the overcrowding in our towns and cities may be attributed to avarice, the desire on the part of landowners to make the most possible out of their land. While saying so much, I wish to say that these remarks should not apply to all landowners, for there are many noble exceptions to the rule, and I believe the City of Cardiff gives a fine example of these exceptions.

Here, I may say, we have many fine wide streets and open spaces, which have been laid out voluntarily by the large landowners, while courts are almost unknown, and narrow streets are few and of ancient construction.

It is mainly due to the small landowners where the ill effects of bad town planning are most prevalent, and also where land companies or syndicates buy up small properties with the object of laying out and reselling at the highest possible price. In such cases, in years gone by, in districts where no building by-laws were in operation, or where such by-laws were inadequate to deal properly with building operations, the effects have been in many instances deplorable, and have resulted in the expenditure of many millions of money by local authorities in clearing insanitary areas, in widening and improving narrow and crooked streets and roads, and in constructing new streets of communication which should never have been necessary had the land been properly planned at the time it was first laid out for building.

What public expenditure might have been saved had local authorities been possessed of sufficient power to properly deal with matters of the

kind even since the passing of the Public Health Act, 1875, it is impossible to say, but it would total to a very large sum.

In the laying out of new towns, such for instance as are constantly springing up in our colonies, the question of town planning is not so difficult a matter. The district of a township would be planned out with its centre of commerce, its public buildings, shopping area, and manufactories; each district being mapped out for the different requirements of the city or township. From the various centres, main trunk thoroughfares of adequate width would be constructed, leading in the direction in which the most traffic would invariably follow, with side streets of varying widths for different classes of residences, suited to the requirements of the inhabitants, and the provision of the requisite parks, gardens, open spaces and play-grounds necessary as lung spaces, and means of outdoor pleasure and recreation. The main thoroughfares would be constructed of ample width, providing for a double line of tramway track of standard gauge, and wide enough for all other kinds of vehicular traffic, especially as in these days of automobiles and road locomotives, it is necessary that all streets, and particularly the main thoroughfares, should be of ample dimensions, not only for present but also for future requirements.

In choosing the site of a township three features are of the utmost importance: (1) No town should be placed where an adequate supply of pure water is not procurable; (2) the site should be at such an elevation that it may be easily drained; and (3) it should be located where suitable land or other means of treating, or otherwise properly disposing of the sewage are obtainable.

It is seldom, however, when a new town is planned, or rather springs up, that these absolute essentials for the well-being of the inhabitants are considered, and the difficulties of water supply, sewerage, and sewage disposal, are left to be grappled with and mastered in the future.

In a mining district, the first and only consideration is where best and most economically can the valuables be won; where and how the workers are to live is too often of secondary or no consideration. In a seaport the first consideration is where best and most economically to construct the docks or harbour, and seaside resorts are generally located by the attractiveness of the sea and beach, and of the beauty of the surrounding country.

In the laying out of an industrial, manufacturing, or market town, however, it is possible to fix upon a more ideal situation, and in such a case the three essentials before-mentioned should have first consideration.

No ideal plan can be laid down as a model for a new town or city.

The planning must naturally depend upon many circumstances, and particularly on the natural configuration of the ground. In a flat district the planning might be as one liked, while in a hilly district the planning must, whether one likes it or not, follow the best lines suitable for building purposes. The planning will also depend very much upon what is likely to be the industry of the district, and the kind of traffic which is likely to be conveyed along the streets of the town, and for a proper idea as to what is likely to meet the case in this direction the only safe method to adopt in the planning is that of ample and sufficient areas in the building sites, with adequate width for streets and roads, and a broad estimate for public parks and open spaces.

But after all, it is not so much the planning of new towns and cities which we have to consider in this country, for these will be few (except, perhaps, in mining districts) compared with our Colonies. We are, however, greatly concerned in the spreading out and enlargement of existing towns and cities, and in the necessity of preventing any repetition of narrow streets and roads, courts and alleys, and in the provision of public parks and open spaces, as well as a sufficiency of open space in connection with every habitation, and that the expansion of our towns shall be upon such lines that future generations will not have to reproach the present generation as we have to reproach our predecessors.

I believe that Cardiff was the first city, or if not the first, at any rate one of the first cities in the kingdom, to obtain special legislation enabling its Corporation to deal in a limited manner with the matter of town planning. Section 53 of the Cardiff Corporation Act, 1894, reads as follows :—

> "The Corporation may by order vary or alter the intended position or direction of any intended new street for the purpose of causing it to communicate in a direct line with any other street or any intended new street adjoining or near thereto or leading in the direction thereof. The Corporation shall make compensation to all persons injuriously affected by the exercise of the powers of this section."

It will be noticed that this clause only deals with the matter in certain instances, and it was brought about in consequence of difficulties having arisen in the planning of estates adjoining each other, where one estate owner, for instance, would not or could not make arrangements with the adjoining estate owner to join up streets from estate to estate in a proper and reasonable manner for the public convenience. In such cases the section of the Act referred to gives the Corporation power to step in and insist upon the streets being carried through from one estate to another:

but even this Act has its drawbacks, because it will be noticed that when the corporation take action under the Act, they have to "make compensation to all persons injuriously affected by the exercise of the powers referred to"; that is to say, they have to purchase the land necessary for making the connecting streets at building land value. The Act also has this drawback: that to a landowner anxious to make the most possible out of his land, it offers an inducement to so plan out his estate that the corporation will be obliged to put the section into force, and compensate him to some extent, a nice and easy way of making a little money to assist in the development of his estate.

The matter of wider streets was entered into very largely by the Corporation of Cardiff when they were remodelling their bye-laws prior to 1900, and was one of the points which for a long time delayed the making of new building bye-laws. My corporation were of opinion that they should have power to require, in certain instances, a greater width than thirty-six feet (the ordinary L.G.B. Model By-Law), for it is well known that a street of a minimum width of fifty feet is required where a street tramway is to be constructed, as nothing less than that will permit of a double line of standard gauge tramway and allow for the standard margins for ordinary road traffic. Modern conditions of street traffic, and the sanction of the L.G.B. to the introduction of road locomotives and motors on the public highways, demanded that streets should in the future be constructed of greater widths than previously. As a result of very much negotiation with the L.G.B., I believe that Cardiff was the first city to obtain the following Bye-Law (2):—

> "4. (1). Every person who shall lay out a new street shall so lay out such street that the width thereof shall be *forty feet* at the least.
>
> "(2). Every person who shall lay out a new street (*a*) which shall be intended for use as a carriage-road, and shall exceed three hundred yards in length; or (*b*) which, being intended to be used as a carriage-road, is in continuation of an existing street intended to be so used, and of a length, including such new street, of not less than three hundred yards, shall so lay out such new street that the width thereof shall be *fifty feet* at the least."

What the corporation wished to have was a discretionary power enabling them in certain instances to require a greater width of street than forty feet. The L.G.B., however, would give no discretionary power, and as a result the by-law requiring streets of three hundred yards and over in length to be made fifty feet in width was obtained.

This by-law, however, like the preceding Act referred to, has its drawbacks. It is not necessary that every street of 300 yards or more in

length should be so wide as 50 feet, while it is very desirable that in other instances certain streets should be even wider than 50 feet. Therefore it appears that a discretionary power to make arrangements with landowners for certain main trunk roads to be of a width of 50 feet or more is very preferable to the stipulation that every street of 300 yards or more in length be of that width.

It also has the further drawback that where a landowner is desirous of making the most possible out of his estate, he may break up the planning of his estate in such a way as to make no street of a continuous length of 300 yards or more. There is an old saying that it is possible to drive a coach and horses through any Act of Parliament, and I may say that it appears possible for any landowner, who so desires, to drive a coach and horses through section 53 of the Cardiff Corporation Act, 1894, and the Corporation by-law respecting the width of streets greater than 40 feet.

When the Cardiff Corporation was discussing with the Local Government Board as to the necessity of by-laws requiring, in certain instances, streets of a greater width than 40 feet, they were told by the official of the Board that if a town or city required a street in any particular instance more than 40 feet wide, it was the duty of the local authority to purchase the land necessary for making the street wider.

Shortly after we had occasion to put Section 53 of the Cardiff Corporation Act, 1894, into operation, and applied to the Local Government Board for sanction to borrow a sum of money for buying a strip of land in order to make a street into a main trunk thoroughfare of greater width than 40 feet. We were then told by the Local Government Board that they could not sanction a loan being raised for the purpose, inasmuch as the street about to be made was not a public highway, and that the money was not required for widening an old highway, so that when we asked for a by-law enabling us in certain cases to insist upon wider streets, we were told by the authorities that it could not be sanctioned, but that we must buy the additional land required; but immediately we wanted to purchase land for making a new street wider than ordinarily, we were told by the same authority we could not be permitted to borrow money for such a purpose, as it would be for developing a private estate.

I have here several examples of bad town planning, showing a condition of things which would never have been allowed, had my Corporation power to prevent them, but the plans when submitted complied with the by-laws, and with the Public Health Acts, and we had no authority to prevent things of the kind being done.

If the Housing, Town Planning, etc., Bill now before Parliament

becomes law, it will entirely obviate the bad methods of town planning I have just referred to, and will put an end to such a condition of things.

The Bill enables a local authority to prepare a scheme "in respect of any land which appears likely to be used for building purposes, with the general object of securing proper sanitary conditions, amenity, and convenience in connection with the laying out and use of the land." It also enables a local authority to prepare a scheme, not only within its boundaries, but also "in the neighbourhood of their area," if the authority satisfy the Local Government Board that there is a *primâ facie* case for making such a scheme. This will doubless prevent bad planning just over the borders of the large cities and towns of the country.

In the Town Planning Bill it also provides:—

> "The use of land for building purposes shall include the use of the land for the purpose of providing open spaces, parks, pleasure or recreation grounds, or for the purpose of executing any work upon the land, whether in the nature of a building work or not, and the decision of the Local Government Board, whether any purpose is a building purpose or not, shall be final."

A local authority is also empowered to purchase lands and lay them out for building purposes.

In the case of a scheme being so prepared as to injure any property, the local authority has to pay such compensation as may be determined after inquiry by the Local Government Board, and in certain events this may be recovered from adjoining landowners, whose properties have been enhanced in value through the preparation of a scheme.

It is to be hoped that the basis of this compensation will not be the inflated value usually put upon land when required for such purposes, plus 10 per cent. for forced sale, on the assumed basis of prospective building value, but that the valuation should be based upon the income or rental of the land prior to its development for building purposes.

There is every prospect that the Bill now before Parliament will very greatly assist local authorities in the better development of the surroundings of existing towns and cities, and it should be hoped by everyone interested in town work that the Bill should in due course receive the Royal assent.

[*For Discussion on this Paper see page 489.*]

TOWN AND STREET PLANNING.

By RAYMOND UNWIN.

THE day has gone by when it is necessary to spend time in advocating that streets and cities should be properly planned, or to expatiate on the evils which have sprung from the haphazard growth of towns during the past century; nor, in these days when the town planning principle has triumphed, should we forget that much good work has already been done in the matter of town improvement. In the ample supply of good water, in the drainage and removal of waste matter, in the paving, lighting, and cleansing of streets, and in many other such ways, probably our English towns are as well served as those in other countries. Moreover, by means of our much-abused building by-laws some of the worst excesses of overcrowding have been restrained, a certain minimum standard of air space, light and ventilation has been secured, and, indeed, in the more modern parts of the town a fairly high degree of sanitation, immunity from fire and general stability of construction have been reached, the importance of which must not be lost sight of: and yet the fact remains, that there have been growing up around our big towns, under the influence of these very by-laws and embodying these sanitary improvements, vast districts, which for dreariness and sheer ugliness it is difficult to match anywhere. How is this? How is it that so much admittedly good work in the past has failed to produce a good effect? It is because we have neglected the amenities of life; we have forgotten that even the poorest cannot live by bread alone; that endless rows of brick boxes looking out on one side upon dreary paved streets, and on the other upon squalid back-yards, are not really proper homes for human beings, and can never become such, however complete the drainage, however pure the water, or however strict the building by-laws under which they are erected. Important as these improvements are, they are incomplete, for the element of beauty has been forgotten.

William Morris said, "Beauty, which is what is meant by Art, using the word in its widest sense, is, I contend, no mere accident of human life which people can take or leave as they choose, but a positive necessity

of life if we are to live as nature meant us to, that is unless we are content to be less than men."

If we examine our town improvement work is it not evident that its failure largely arises because we have forgotten this fact? We have sought to house our people as if they were less than men.

We shall, indeed, need to carry much further along the same lines the good work begun by our sanitarians and the framers of our building by-laws; we shall need especially to secure more open ground, air space and sunlight for each dwelling. We shall seek to make proper provision for parks and playgrounds; to control the planning of our streets, their width and their character, so that they may in the best possible manner minister to the needs of the community. We shall hope to reserve suitable areas for our factories and workshops, where they will have every convenience for their work and where also they will cause the minimum of nuisance. All these and many more practical improvements town planning will render possible; but if this work is to be successful we shall need to infuse into it the spirit of the artist, he who is not content with the least that will do, but desires the utmost that can be attained. It is that small margin, marking the difference between a thing scamped and a thing well done, which really counts. It is from this margin of well doing that beauty springs. Dimly this has been discerned, dimly in seeking for powers to regulate the development of their towns the people have been seeking freedom to become as it were the artists of their own cities, portraying on a gigantic canvas the expression of their life.

Now beauty is an elusive quality, not easily defined, yet it is a necessary element in all good work, a crowning and completing quality. We are too much in the habit of regarding art as something added from the outside, some species of extra trimming put on. Much evil springs from this misunderstanding. Civic art is too often taken to consist in filling our streets with marble fountains, in ornamenting our squares with groups of statuary, in twining our lamp posts with wriggling acanthus leaves or dolphins' tails, and our buildings with meaningless bunches of fruit and flowers tied up with impossible stone ribbons. This is not art in the sense in which Morris used the term or in which it is used here. The beauty which we regard as necessary to full life is not a quality which can be plastered on from the outside; rather it results when life, and the joy of life working outwards, expresses itself in the beauty and perfection of all the forms which it creates for the satisfaction of its needs. Such exuberance of life will indeed in due course find expression in adornment, but our business at present does not lie in that direction. While the mass of the

people live in hovels and slums and our children grow up far from the sight and pleasure of green fields and flowers, while our land is laid out solely to serve the interests of individual owners, this is not the time to think of the crowning beauty of ornament. Rather for us must art consist in the well doing of what needs doing. At least in our town-planning work let us not repeat the mistake which we have made in the past of disregarding the amenities of life. Let us frankly admit that the beauty of our towns must be maintained and developed, and let us see that in addition to proper guidance on sanitary and engineering matters we secure also that the work shall be considered from the point of view of beauty, that the artist or the architect shall have his voice in the arrangement of the plan.

In town-planning, as in architecture, much may be learnt from the past. The history of the art of town-planning remains yet to be written, but at any rate we know that it dates back some 5,000 years. Professor Flinders Petrie has related how about that period there was built on a definite plan the ancient town of Cahun for the accommodation of the workmen engaged in the building of the Egyptian pyramid of Illahun. The streets were laid out in an orderly manner, they were provided with a central gutter or drain, and the workmen's houses built in this town contained four or five rooms each. Town-planning on a scale of extraordinary magnificence was carried out by the Greeks, the Romans, the Assyrians, and many other ancient races. Not a few towns were planned as a whole in the Middle Ages. The town of Winchelsea in England is an example of one of these, and at the period of the Renaissance and in more modern times much work has been done, particularly in continental towns, in the development of town-planning. In Germany there is a considerable literature on the subject, and a monthly periodical, "Der Staedtebau," dealing with it has been published for several years. It is of the utmost importance that we in England should study this work and should learn to avoid some of the mistakes which have been made in Germany, where in many cases much waste of space and money has been entailed by the adoption of roads of excessive widths and needlessly expensive character. There has too, in Germany, been considerable tendency for town-planning to result in the destruction of existing beauty in the older parts of the town, without the creation of any compensating beauty in the newer portions, which have tended to be all drilled into stereotyped forms by ill-considered central regulations.

Before therefore any plan for a new town, or for a scheme of town development, can with prudence be commenced, a very thorough survey

should be made of the whole problem. Professor Geddes in several stimulating essays has pointed out that this survey can hardly be too wide or too thorough. The town which seeks to take in hand and guide its own future development must first thoroughly know itself.

On the sociological side, Seebohm Rowntree's survey of York and Tom Marr's of Manchester may be quoted as good examples. A thorough examination and survey of the whole town should clearly be made, sufficient to enable maps based on the ordnance survey to be prepared, coloured to indicate such matters as the degree of density of population in different portions of the town, and any insanitary areas or areas of special poverty; the distribution of residential, business and manufacturing areas throughout the town, with such sub-divisions as may seem desirable, and also the distribution of parks, public open spaces and other vacant places and their extent.

In most towns there exists already much material of the nature of an historical survey, in connection with which there would need to be collected a series of maps showing as far as possible the past development of the town, and also showing all public buildings, ancient monuments or places of historic value, general interest or special beauty, such as should be preserved. For use in comparison and suggestion, plans should also be collected of towns similarly placed, and particulars, as far as available, of town-planning work carried out in other countries. Geological maps would be required, also diagrams showing climatic conditions, prevailing winds, rainfall, etc. Further, the survey should include all local traffic conditions, relative intensity of the daily inward and outward flow of population in different directions, the possibilities for extension of railways, tramways, waterways, etc. Particulars of local industries, specially of those which show signs of increasing, with the nature of any special requirements necessary for them, should be collected. All existing water supplies and drainage systems, with the limitations of height or depth to which they are available, and their capacity for increase, should be scheduled, together with any marked tendencies of the town to grow in certain directions; while local requirements, customs or prejudices affecting the size and character of building plots, and local conditions as to building materials and traditional methods of building would be of great value. Future requirements in the way of sites for schools or other public buildings, playgrounds, parks, and open spaces, should be foreseen and provided for.

Such then, very shortly summarised, is the city survey which should be made before the plan of any extension is attempted. None of this

information can be dispensed with if a good plan is to be made. On the thoroughness of this survey will depend both the economic success of the plans for future development and the preservation of the city's individual character by which alone the poetry of its existence can continue to cling to its enlarged self.

We have already sacrificed too much of the individuality of our towns. This has been partly due to the ease of modern long distance transit, which tends to mix up all our building materials in one monotonous jumble spread all over the country. The tiles of the eastern counties invade the slate districts of Wales, while the Welsh slates displace the tiles of Staffordshire or the stone slabs of the Derbyshire village; and in this and other similar ways local characteristics, which arose in old towns from the common use of local building materials and which greatly contributed to produce the individuality of different towns and districts, are being rapidly lost.

In addition to the general survey referred to above, the town planner must himself make a careful study of his site, which should include the preparation of a contour plan of the whole area to be dealt with, and a careful survey of existing trees or other features of interest or beauty which may be incorporated into the design.

There is much discussion among town planners as to whether the design should follow formal or informal lines. The subject is too wide a one to be dealt with here. It seems to me that it is, generally speaking, natural for man to carry out his works to a definite and orderly design. In the laying out of land, however, all such designs should be made with due submission to the conditions of the site and should be inspired by a full appreciation of its suggestions. To commence the work by straightening all the watercourses, levelling the undulations, and clearing away existing trees, in order that there may be prepared a clear field upon which to develop some designer's pet scheme would seem to be presumptuous folly.

What is needed to guide the town planner is not so much a strong prejudice in favour of either formality or informality of treatment, but first such a respect for his site and for the natural beauty which he may find there as will make him realise the importance of incorporating his design with the site and so arranging his scheme that it may be the means of harmonising as far as possible the buildings with the surrounding country; and second, such a clear belief in the beauty of orderly design as will save him from the mistake of imagining that any natural beauty can arise from mere aimless informality. We can forgive the designer who leans rather much to formality of design, as we can forgive the one who

too excessively sacrifices his design to the minor features of his site. It is the mere aimless designer who considers that there is virtue in mere informality whom we cannot forgive.

Time will not permit here of our considering the relative advantages of straight streets and curved streets and the different kinds of street pictures which can be produced in each: nor the question of enclosed places and open places, of separate street junctions or focal points where many streets meet, of the best ways of managing each to facilitate traffic and to produce good effect; but a great number of such matters must be studied in connection with the town plan. In all large towns special attention should be devoted to the question of traffic, for the solution of the housing problem in our large towns undoubtedly depends on a combined use of cheap transit facilities with the development of garden suburbs or garden cities on the outskirts or in the near neighbourhood of the towns themselves; and perhaps the most pressing need of the moment is for the arranging and planning of such suburban developments as will effectually relieve the congestion at the centre of our towns.

Having selected the districts most suitable for development as residential centres and provided the necessary transit facilities by rail tube or tramway, our first care must be to limit the number of houses to the acre which may be built in these suburbs. The experience of Letchworth, Hampstead, Earswick and Bournville all teaches that probably twelve cottages to the acre is about the right number for suburban districts. This gives a sufficiently large garden to be worth while cultivating and not more than can be easily managed by an ordinary family without outside help. It affords ample ground for play places for children, bowling greens or tennis lawns for the elders, in addition to the garden plots. Whatever means we take for limiting the number of houses to the acre the rules must be of a flexible character to allow of varying the size of garden to the individual houses and of the devotion of portions of the land for the purposes mentioned above. In places where it may be found that any considerable number of tenants are not able or willing to cultivate the whole of their one-twelfth of an acre, the gardens may be reduced in size, and the land thus set free may be devoted to allotments or greens. Considering that building by-laws commonly allow from forty to sixty houses to be built on an acre, and in all these measurements I am excluding the roads, twelve to the acre may be regarded in some places as a counsel of perfection; and perhaps where sites are at all near to the centres of towns a rather larger number of houses may be permitted. But when the number exceeds twenty to the acre undue crowding undoubtedly

commences. It becomes necessary either to reduce the length of the gardens and the space between the backs of the buildings to an unpleasing and unwholesome extent, or, what is more commonly done, to curtail the length of the frontage allowed to each house until the long straggling back projections, which are the curse of our modern suburban cottages, are rendered necessary. These projections, which are uncontrolled by our present by-laws, are simply re-creating in another form what are virtually back-to-back cottages opening upon narrow blind alleys, sometimes not more than ten or fifteen feet wide, into which little fresh air and less sunlight can ever penetrate. If the number of houses to the acre can be reduced to something between ten and twenty it will at once become possible to give reasonable frontage for each house. It will become possible to so plan the sites that not only shall there be ample air space for every house, but there shall also be abundant sunshine into all the important rooms of every house and a cheerful and pleasant outlook over some green or garden space from all the windows.

But, if this Garden City type of development of the suburbs is to be practicable, we must reconsider our ideas as to roads. The present custom is to fix a minimum width of from 40 to 50 feet, and to require that all the roads within a given local government district shall be macadamised, kerbed, channelled, and asphalted to one specification, regardless of whether they are main roads, which will some day require to be widened at great expense to the public to provide space for tramway lines, or whether they are simply building roads giving access to a few cottages. A simple carriage drive of from 13 to 16 feet in width is found ample for all the traffic that passes to and from a great mansion, such as Chatsworth or Blenheim, and no temptation would induce the owners of such a mansion to make one of our by-law roads leading up to their home. Why then may not a simple well kept carriage drive give all the access that is required to a dozen or two cottages, the traffic to which would be as nothing compared with that which passes to and from the great mansion. Instead of a dreary space 40 or 50 feet wide accumulating dust and radiating heat, we might have in front of our cottages a broad space of grass planted with trees, and a simple carriage way giving access to them. This would very greatly reduce the expense of road-making, and would in turn enable those who are laying out the land to give greater length of frontage to each cottage.

Town planning powers are about to be given to us. They may indeed need further amendment, but they do make it possible for us to take in hand seriously the improvement of our towns and the housing of

our people in healthy and beautiful surroundings. It remains for us each in our own district to give thought to the subject, to realise the new possibilities; and may I again urge that in all we do we shall remember that man is not a mere beast of burden, that in addition to having a body needing to be housed in sanitary conditions, he has senses of sight, of hearing and of smell which need to be rested and recreated if he is to be in full vigour; that he has a mind needing interest, recreation and repose: that he has a spirit needing to be cheered and uplifted, and that we know of no better or more practical way to provide for all the higher parts of man's nature the rest and recreation they require than to bring within his reach the quiet, the beauty, and the healing influences of nature. Let us surround his cottages with gardens, provide greens for his children to play on, and blossoming trees to decorate the roads down which he passes daily to and from his work, and we shall have done much not only to check physical deterioration, but to stimulate mental growth and that peace of mind which is so necessary to the true health of the whole man.

[*For Discussion on this Paper, see page 489.*]

STREET AND CITY PLANNING.

By HENRY MICHELL WHITLEY, M.Inst. C.E.

BEFORE dealing with the modern practice of town planning, it will be instructive and interesting to trace the historical development of the art of city building, from the times of the Romans downwards to the present day.

These plans cannot be studied in all their architectural beauty in this country, as existing remains above ground are so scanty, but abundant examples are to be found in more southern climes, in Italy, and perhaps still more in Palestine and Syria, from which the author has lately returned.

In these countries city building was carried out on a scale of grandeur and magnificence, especially after the destruction of Jerusalem, when Roman colonisation was more widely extended, new towns rising on all sides under the auspices of the governors, or at the expense of the emperors, especially Trajan, A.D. 98.

These towns were laid out on the rectangular system, with two main streets at right angles intersecting one another at the centre, where a tetrapylon was placed, whilst on both sides of these main colonnades, the temples, the municipal buildings, and theatres stood. One of the most perfect of the ruins of these cities is

Jerash,

which lies about 50 miles N.E. from Jerusalem.

The town is entered from the south through a large triumphal gate, resembling Trajan's arch at Rome; to the west of this is the "Naumachie," or theatre for the representation of naval battles; further north, and closely adjoining, is a large circus; all outside the walls of the city.

On the western side of the south gate is a temple, and closely adjoining it the southern theatre, 288 feet across, with 32 rows of seats.

North-east of the theatre is a semicircle of 56 Ionic columns still connected by an entablature, which probably enclosed the forum.

From the centre of this semi-circle, the great colonnade (the main street of the city) starts, and intersects it from south to north, it is about half-a-mile long, and 41 feet wide between the columns, of which there are 520 varying from 20 to 30 feet high, mainly of the Corinthian order,

with fine acanthus capitals, but some towards the forum and the north gate are Ionic.

A second row of columns runs along both sides of the street, with covered arcades along the fronts of the houses, sheltered from the heat of the sun, with open galleries above, on a level with the first storey.

At the intersections of the two main cross streets tetrapylons were placed, formed of pedestals enriched with statuary, supporting domes. These two cross streets were also flanked with columns.

The great temple of noble grandeur, probably dedicated to the sun, the tribune in the shape of a semi-circle, with a fountain in the centre, and the large basilica closely adjoined this main colonnade; whilst the baths and the gladiatorial theatre were placed along the northern cross avenue.

Palmyra.

Another fine, and better known, example is Palmyra, which reached the height of its splendour under Zenobia (A.D. 267) and fully adopted the Græco-Roman culture.

Here the great street of columns, entered by a fine triple archway, is nearly three-quarters of a mile in length and of fine proportions, having had originally 375 Corinthian columns on each side about 55 feet high, connected by an entablature, flanked on each side by a covered colonnade which probably contained shops, whilst above was an upper gallery also roofed in.

All the columns are furnished with corbels, which once bore statues of worthy citizens, whose names may still be read in many cases.

Midway at the intersection of a cross colonnade, was a tetrapylon constructed of huge monoliths of Egyptian granite, and beyond this the colonnade bends slightly to the north, probably for perspective reasons.

The architectural effect of this columned street when perfect must have been magnificent, and the protection from the sun afforded by the covered colonnades of the utmost utility.

Not only were these towns planned on symmetrical lines with streets, as a rule crossing one another at right angles, and architecturally perfect, but their sanitation was good, and especial pains were taken to provide an abundant and pure supply of water.

When the author was at Latakia (*Laodicea ad Mare*) last June he spent some time in investigating the remains of the Roman town and harbour. The triumphal arch at the entrance to the old city is an architectural gem: the ruins of the great temple, that of the forum with its massive columns of Egyptian porphyry, some still bearing the names of

the citizens who gave them, and the craftsmen who wrought them, are still in existence; and from an artistic standpoint more valuable than all, a fragment of a column of pure white marble encircled with dancing girls carved by a master's hand. The life and motion of these figures, and the swing of the drapery, are, in their realism, second only to the celebrated *Nike of Samothrace* in the Louvre.

The author was fortunate enough during his stay, to have his attention drawn to the remains of the Roman aqueduct which supplied the town with water, traced it to its head weir on the Nahr el Kebir (Great River), a distance of 25 miles, and had it planned by his surveyors. For many miles it is perfect with its tunnels and numerous bridges, including an aqueduct 665 feet long, which when first built had a double stage of 14 arches, each 30 feet span, and 60 feet above the bed of the river, and he cannot help putting on record a tribute to the genius and skill of the Roman engineer who designed and carried out this great work 1,700 years ago.

Silchester.

One of the most valuable examples of a Roman city in England is Silchester in Hampshire, the ancient Calleva. Stormed, sacked, and burnt, after the withdrawal of the Roman legions, it has ever after remained waste and uninhabited, and the excavations which have been carried on in recent years have resulted in the recovery of the perfect plan of the city.

The walls, about $1\frac{1}{2}$ miles in circuit, still remain, although stripped of their outer facing, the usual arrangement of four main gates, with wide streets connecting them intersecting in the centre, was carried out here, with subsidiary cross streets, dividing the city into rectangular blocks.

The forum, basilica, and curia, were placed close to the main crossing, the public baths were near the south gate, and a large amphitheatre stood outside the walls.

The dwelling houses had a foundation of masonry, the superstructures, in the majority of cases, being of timber.

New Winchelsea.

Coming down to mediæval times, a good example of a new town designed on the rectangular system is New Winchelsea, built in the thirteenth century by King Edward I. to replace Old Winchelsea, which was situated on a low sandy island, and was swept away and drowned, by great storms and inundations.

The new site is on the tableland of the promontory of Higham, with steep banks around, and surrounded on three sides by the sea.

Broad straight streets, crossing each other at right angles, divided the town into thirty-nine squares or quarters, on the central one rose the glorious church of St. Thomas à Becket, whilst massive gateways defended the approaches.

Deserted by the sea, Winchelsea has wasted away to a country town, but its scale of planning attests the foresight of its kingly builder.

The Irregular Plan.

With the departure of the Romans, and the destruction of the greater number of their cities, the art of regular town planning in England died out, for the Saxons were no builders, and towns grew up in an irregular fashion, the houses mainly gathered along the old roads leading to them.

London is an example. "Augusta" of the Romans, as far as is known, lay deserted and silent for a long period, after the withdrawal of the legions, and the original geometrical plan was buried under débris and soil accumulations, until at present the Roman pavement of Cheapside lies eighteen feet below the modern one, whilst an irregular plan replaced the former regular one.

Within the walls London was hide-bound also by the great monasteries, whose buildings and gardens almost entirely encircled the city within its walls, and it was not until the dissolution that this ground became available for building. The land between the Strand and Watling Street was gradually covered, whilst towards the end of the eighteenth century, in order to meet the demand created by the increasing wealth of the merchants of the city for a better and more sanitary class of houses, the great estates of the nobles adjoining what is now Oxford Street, were laid out for building on a regular plan, and in a liberal manner, large, airy, with well planted squares, surrounded with terraces of houses, and frequently designed on broad lines with a view to architectural symmetry.

The Radial System.

This system consists in emphasizing certain important points in a city. At these spots a circle is placed with a statue, arch, or fountain in the centre; from this point broad streets radiate in all directions. This system has not been so freely adopted in England as on the Continent, where it was in use as early as the thirteenth century.

Paris, as reconstructed with its new boulevards and avenues, under M. Haussmann, is a magnificent example of this mode of planning.

Twelve avenues radiate from the Arc de Triomphe, three of which are 300 feet wide, seven more than 1,000 yards long, and in five directions

there is a clear view of a mile, most of these streets having a width of over 100 feet.

From other centres similar streets radiate, the majority of systems, however, being on a smaller scale.

The rectangular system has been generally adopted in North and South America: and the City of Santa Maria de Belem, Brazil, the capital of the State of Para, is a good example. This town was founded in 1616, but little was heard of it until the middle of the 19th century when it entered on a career of surprising prosperity, mainly caused by the rubber industry, the city rising in population from 5,000 in 1850, to about 120,000 at the present time.

The author visited Belem recently in order to design a scheme of sewerage works, and report on proposed new boulevards, and made a careful examination of its streets and squares.

The lands adjacent to the city are the patrimony of the municipality and are bounded on the north and west by the River Guajará, and on the land side by a semi-circular boulevard, struck with a radius of four miles from the Bishop's Palace.

The streets in the older portion of the city are narrow and irregular, but those in the newer part are broad and well paved with granite setts, whilst the boulevards are bordered with palm and other trees.

Numerous squares are laid out, and planted with flowers, palms, and shrubs: and the whole district within the municipal boundary, far beyond the existing roads and buildings, is planned out in one comprehensive scheme.

The main avenues, with trees on the edges of the footpaths, are 82 feet, and the secondary roads, 65 and 50 feet wide, respectively: whilst the rectangular building blocks between them vary from about 656 to 984 feet in length, and 328 to 492 feet in width.

The bulk of this land laid out is forest, and three miles from the city a municipal wood has been enclosed, and well laid out with water, cascades, winding paths, and shrubberies, and the site for another wood has also been reserved.

The effect of this foresight is that the expansion of the city is regulated on well thought out lines, and irregular or ill-designed suburbs are avoided.

MODERN TOWN PLANNING.

Towns should be planned on a comprehensive scheme, which should be on broad lines.

The best laid out towns are those which are in the hands of one or two

great landowners only, who have ample funds to retain the services of competent professional men, not only to plan the town, but also to design the houses, and maintain a high standard of architectural excellence in contradistinction to builders' architecture, with which so many new suburbs are disfigured.

On the other hand, the most unsatisfactory towns are those which are owned by a large number of small proprietors unable to employ competent men, and anxious to realize the utmost sum from their small holdings, each being laid out to the best individual advantage, without considering the effect on the remainder of the lands which the town is spread over.

In town planning a combination of the systems already described with contoured roads in the suburbs, will produce the most pleasing result.

The rectangular system has many advantages, but it has the great disadvantage of entailing a longer distance in getting from point to point, and diagonal streets, radiating from the centres of business and pleasure, such as the railway station, town hall, theatre, etc., should be combined with such a plan.

The principal business streets of the town should be straight, but in the suburbs, where detached houses are built, curved lines give the best effect.

Straight streets should not exceed half a mile in length, for long, straight streets are especially liable to dust clouds. Spacious and handsome streets, with good sanitation, should be supplemented, however, with artistic houses, designed by a qualified architect.

English people are gradually getting more appreciative of beauty and art in their surroundings, and large numbers will not live in inartistic and monotonous dwellings, however sanitary they may be, and this feeling will probably gather force as years go on. A town designed, however, on artistic lines has a beauty and comfort of its own which renders it an ideal spot for residence.

Width of Streets.

For towns of fair size, and where a considerable traffic may be expected, it is inexpedient to lay out through streets and roads of a less width than 40 feet, and for busy thoroughfares 60 feet should be the minimum, with footpaths together one-third of the total width.

This width of 60 feet allows for two footpaths each 10 feet wide, and a roadway 40 feet wide, which will take a row of carriages on each side of the curb, and leave space for three rows of traffic between.

For the business thoroughfares of large cities, 80 feet is not too wide.

The Royal Commission on London Traffic advises the following widths for new streets:—

Main Avenues.	Each footway.	Roadway.	Full width.
1st Class Arterial streets	... 23 ...	94 ...	140
2nd „ „	... 18 ...	64 ...	100
3rd „ „	... 16 ...	48 ...	80
4th „ „	... 12 ...	36 ...	60
For development of suburban land	8 ...	24 or 34 ...	40 to 50

The heights of the buildings should be proportionate to the widths of the streets. In all cases the latter should be of a uniform width throughout, in order to avoid a congestion of traffic.

London, with most cities and large towns, suffers from the inadequate width of its streets, the average width of new streets constructed by the Metropolitan Board of Works being 60 feet; but the increasing use of tramways and motor omnibuses demands liberal treatment in this matter.

Avenues or boulevards with trees, should be from 80 to 100 feet in width, with a strip of turf about eight feet wide on each side of the roadway on which the trees, about 30 feet apart, are planted; beyond this strip, and adjoining the boundary walls of the houses, would be the pavements, 10 feet wide each.

It is advisable to keep these turf strips well mown, and to enclose them with a light low fence, to prevent the turf being destroyed by foot passengers, whilst means of access to the houses from the roadway should be provided.

If this is not done, it is difficult to maintain the turf in order; and town councils sometimes remove the turf, and either gravel or brick over the slip.

Trees suffer from lack of water when bricked around, and also from being barked by horses being tied up to them, and the author has seen a large number of trees destroyed in this way. Ample iron gratings and proper tree-guards should be provided and maintained.

Streets in which trees are planted should be of ample width, otherwise the trees when fully grown render the houses dark, and the occupiers complain, and ask that the trees should be thinned out.

The fronts of the houses in good residential and suburban districts, should be set back at least 30 feet from the centre of the row of trees.

The plane and the small leafed elm do well in the south of England.

The author makes it a practice never to cut down a fine tree in developing a building estate, unless under absolute necessity: by a little

thought, and by judicious planning, this pernicious habit, so prevalent in the suburbs of London, and which destroys the beauty of a residential suburb, may be avoided.

If a row of handsome trees exists by the side of a roadway of insufficient width, it can be left untouched on a strip of turf of ample width, curbed and channelled, as an island, the roadways being carried on each side of it; or if the road is not to be widened, the houses may be set at an adequate distance, the trees left, and a grass lawn kept well mown and protected by posts and chains, with a private carriage drive along the fronts of the houses.

Pavements.

Where possible and the traffic is light, the author uses red paving brick. Its colour is pleasing to the eye, it is springy to walk on, and dries rapidly after a shower; asphalte remains wet and muddy long after the brick pavement is dry.

Tar pavements are unpleasant in colour, and hot and dusty in summer. For the footways of the urban portion of great cities, natural stone pavements are the most durable and best.

Heights of Houses.

In order to produce a pleasing effect and to admit ample sunshine and air to the dwellings, the heights of houses should be in proportion to the breadths of the streets along which they are built; for an ordinary street, the width between the fronts of the houses should equal their height.

For such free admission of sunshine, the widths of the streets should increase, and the heights of the houses lessen, the further north the town is situated. It has been stated that children brought up on the ground floors of artisans' dwellings in London are sicklier than those residing on the higher floors of the same buildings, where they have more sunshine and air.

In Paris the houses are built to the following heights, subject, however, to revision in exceptional cases. The measurements are taken from the highest point of the paving to the entablature:—

In thoroughfares less than	25 ft. 6 in.	wide,	39 ft. 6 in. high.
Do. from	25 ft. 6 in. to 32 ft. 0 in.	„	50 ft. 0 in. „
Do. „	32 ft. 0 in. to 65 ft. 6 in.	„	60 ft. 0 in. „
Do. „	65 ft. 6 in. and upwards		65 ft. 6 in. „

In the business quarters of large cities, where the price of land is exceptionally high, and in numerous cases is still rising, the principles

enunciated cannot be fully enforced, and as the premises are mainly used for business purposes, there is not the need for such restrictions as are necessary in the residential portions of a town; but still the thoroughfares are dark and often sunless, while the American skyscraper, samples of which are in existence in England, is unsightly, and fatal to architectural symmetry. Some restrictions seem needed, in the public interest, to control private liberty, and regulate the erection of such towering buildings.

Squares and Open Spaces.

In the designing of a modern town, ample space should be allotted for this purpose. The village green and the broad market place in country towns, are examples to be followed.

Squares or rectangles of houses set around gardens, form a pleasing feature in a building estate. The gardens are usually reserved for the use of the occupiers of the houses, a small additional yearly rent being charged for the privilege in the lease from the ground landlord, who keeps them up.

The gardens in a square should preferably be of the same shape, with well-rounded corners, although an oval looks well, but is subject to the disadvantage of a great waste of land at the angles of the square, and consequent varying width of roadway.

For rectangular gardens, a length of three times the width, is a good proportion: in some cases these gardens are placed at the backs of the houses, from which there is direct access to them.

Squares and gardens should be kept as low as a proper provision for drainage will allow, be well planted with trees, shrubs, lilac, laburnum, etc., and have spaces of turf set apart for games.

Terraces of houses have been usually built around squares, but about thirty years ago such houses began to get out of fashion, and an increased demand for detached houses set in. The author has laid out no more residential terrace houses of a high class since (except in exceptional circumstances), or sanctioned any private basement houses. Servants generally dislike living in the latter, and tenants are difficult to obtain. A basement built town now has usually an exceptionally large number of empty houses.

The evils of bad planning are often seen conspicuously on entering a town by railway. The line runs in many cases between rows of mean cottages, backed on to it in order to save a small amount in the cost of laying out. It is needless to say such squalid gardens and sanitary conveniences are most unsightly. A broad road should run alongside the

railway on which the houses would front, the backs being opposite one another: in such a case it would be necessary (by an arrangement with the Railway Company) to leave sufficient space for additional lines of way when required.

The Housing and Town Planning Bill.

The object of this Bill, so far as it relates to the second purpose, is to enable the Local Government Board to authorise a local authority (which means the council of any borough or urban or rural district) to prepare a town planning scheme within its area, and failing local action, provided the Local Government Board are satisfied of the necessity of the same, the Board could order the local authority to prepare a scheme and submit it for approval, and when approved it shall have effect as if enacted in the Act.

This Bill is a step in the right direction, namely, of providing that future extensions of our towns are laid out on one broad scheme, which plan should be settled in conference and co-operation with the landowners, and be subject to the approval of a central authority guided by the best expert advice. Both French and German municipalities possess far greater power than similar authorities in England, and the former are in the habit of making plans for the future development of their towns. The Royal Commission on London Traffic advises that all new streets, when ground previously unoccupied is to be built upon, should be laid out of sufficient width, and in accordance with a proper plan: that power to define frontages be given to local authorities, but that special provisions, where an undue proportion of building land is required for main traffic, should be made, with, in all cases, power to appeal to a central authority: and they also point out that in the absence of some controlling authority, the widths of roads in many of the London suburbs are defined merely with reference to local convenience, and the wishes of the owners of the building sites.

In France far greater foresight has been exercised. About 1750, instructions were issued that every town of more than 4,000 inhabitants should prepare a plan of its streets, together with recommendations as to the future lines to be adopted.

In Paris, the Prefect of the Seine has extensive powers. In 1793, a commission of artists laid down the various improvements which seemed desirable to them, and many of these were gradually carried out.

In order that the Prefect may have independent technical advice on architectural questions, there is a standing council of experts presided over

by the Minister of Fine Arts, the members of which are chosen from architect members of the Institut de France, and leading architects of the day. The result of the remodelling of Paris shows the importance of having a well thought-out plan on broad lines, which can be carried out gradually from time to time, until the whole scheme is fully realised.

The widening of streets insufficient to accommodate the traffic, not only of the present day, but what may reasonably be expected in the future, is an important question. In France widened frontage lines are laid down in such streets with provision for rebuilding in accordance with the same when the houses are worn out.

The advisory Board of Engineers to the London Traffic Commission advise that all such streets as evidently require widening should be so declared, and scheduled without delay, and that all occupation of forecourts or gardens within a prescribed distance from the centre of the roadway should be forbidden under proper arrangements for compensation.

This prohibition of buildings over forecourts is much needed, as shops built in such situations with dwelling houses behind, with access through the former are dangerous in case of fire, unless exceptional precautions are taken. It appears to be desirable that the powers advised for London, with any needed modifications, should be extended to the country generally, and if powers for planning and widening are exercised judiciously, with full consideration for the interests of all parties concerned, joined to a higher standard of architectural merit, the results would not fail to be beneficial to the future development of English towns.

[*This Discussion applies also to the paper by* MR. WILLIAM HARPUR, *page 465, and* MR. RAYMOND UNWIN, *page 471.*]

MR. W. KAYE PARRY (Dublin) said the speaker referred to the difficulties which resulted from the existence of short leases and sub-leases in postponing the period at which improvements in town planning were rendered possible. In Ireland in the case of one town with which he was connected the projected roads which the landowners were willing to construct could not be made owing to the existence of these leases. He trusted that in any legislation which was contemplated some machinery would be provided to deal with this difficulty.

MR. J. WALKER SMITH (Barrow-in-Furness) said that he did not see any great difficulty in town planning itself, but the difficulty was the means to enforce the development of the town upon the lines laid down.

Birkenhead had evidently been laid out on good and liberal lines, but the

Town Council must have had something beyond the ordinary powers to enable them to put their scheme into effect.

Paris was, perhaps, the most perfect example of the radial system of town planning in existence, and Frankfort-on-Main was an admirable example of town planning. The means at the disposal of Paris and Frankfort were largely accountable for the excellent results in those cities, for in Paris Baron Haussman had almost absolute power for the acquisition of property, and unlimited funds at his disposal. In Frankfort-on-Main the excellent results were largely attributable to the power which that corporation had freely exercised, and to such an extent that they were the owners of 75 per cent. of the area of the city. They had bought at agricultural prices the land which previously surrounded their city, and as that land had become developed by buildings so they had extended their purchase; always buying, upon the periphery system, their town area at agricultural prices, and obtaining for the benefit of the municipality the increased value consequent upon development.

Mr. Harpur had referred to certain additional powers to those nominally possessed which the Cardiff City Council had recently become possessed of, but on looking at the section that Mr. Harpur quoted he found it was practically an extract from the Barrow-in-Furness Act obtained in 1875.

The Corporation of Barrow had very extensive powers for the development of their borough, the exercise of which had resulted in there being an absence of slums. It was by their local Act left with the municipality to decide what the width of new roads should be from 80 feet downwards, and from their decision there was no appeal. The minimum width of street was 40 feet, and by the powers of their Act the lines which new streets should take were determined by the Corporation, and a builder was prevented from putting one brick upon another until the street had been laid out in accordance with the lines and the width which the Corporation prescribed, and the kerb and foundation had been laid.

The clause in the Town Planning Bill that seemed to him to be of the greatest value was the one that permitted corporations to purchase land.

Mr. J. Munce (Belfast) said that some of the powers referred to in Mr. Harpur's paper as new had been in force in Belfast from 30 to 40 years.

Since 1865 the Corporation could require a new street to be made 70 ft. wide, but under no circumstances did they permit one to be less than 30 ft. Houses could also be kept back 35 ft. from streets where less than 70 ft. wide.

This distance could be fixed when the building plan was lodged, but was usually dealt with at the same time as the street plan.

Streets need not be made too wide if the buildings were set well back, because a wide street was more expensive to repair, cleanse, and light; better make it suitable for the traffic likely to use it and leave our successors to widen it, if need be; they would not require to buy buildings for the purpose, front gardens

only. This method secured the air space, prevented overbuilding, and made the locality healthy. The tramways were laid in streets 60 ft. wide and upwards, which had proved of immense advantage. When plans were lodged for laying out new streets the surveyor required the streets to be of such widths as he thought right, and had the ground to widen the existing road or street given up, the compensation being the street works on the land given up.

Sec. 48 of Local Act, 1878, enabled the position and direction of any new street to be altered; the defect in the Act of 1865 was remedied by Sec. 45, so now cross streets could be required every 200 yards, whilst Sec. 63 provided that no building in a street made since 1878 could exceed the width of that in height, and Sec. 84, that no new dwelling-house could be erected in any street unless there was an open space of 30 ft. in front (that prevented dwellings being erected in old narrow streets unless they were set to give the space in front) compensation was not payable in any of the foregoing. Under Sec. 51, Act 1878, if the corporation wished a street laid out in a particular place before the owner was ready to do so, they had power to do it, and pay the whole or part cost.

Another very valuable power was that conferred by Sec. 46, Act 1850, whereby better pavements and larger sewers than usual could be asked for in view of future drainage and expense of repair, etc., and the corporation paid part of the cost.

If lines of widening required in existing streets and roads, and building frontage lines were laid down on the town plans, so that anyone calling at the office could see what was proposed, it would save a good deal of worry to the official and heartburning to the owners. His experience was that owners fall in with reasonable views, but he was afraid in some towns the lines were not settled until it was seen who the developing owner was, and then personal feeling on the part of councillors came into the case, and impulsive decisions resulted.

Mr. C. H. Cooper (Wimbledon), dealing with Mr. Harpur's reference to the avarice of the landowners, observed that if one wanted to see the best-planned towns in this country one would go into those districts where practically the whole town belonged to a single individual. He could point to many examples which to a great extent refuted what Mr. Harpur had said. In many instances landowners offered ground to the local authorities for the widening of streets, but the local authorities declined to accept such offers unless the roads were made up by the owners, the result being that land was lost to the towns. Lately he had had to approach a speculator for a quarter of an acre of land, and he had no difficulty in getting what was wanted, providing the council fenced in the ground. His experience was that if one approached owners at the proper time and in the proper way, one always got what was required. If the landowner were such a fearful wretch as he was supposed to be why in the world did he set back his houses? Time after time, when houses were set back in that way

the local authority afterwards allowed them to be brought out to form shops. If anyone were to blame in this matter he thought it was the local authority and and not the landowner.

Mr. E. W. M. Corbett (Cardiff) said that, as a rule, on the Marquis of Bute's estate, for which he was the surveyor, they, in laying out land, had as far as they could foresee provided main streets to accommodate through traffic, and instanced Cathedral Road, which had been formed for many years before it was built over. He thought the majority of landowners would not object to a street planning act which would prevent the laying out of land in a selfish and avaricious manner, but if such an act was to be accepted and become a success, where a man's land was taken for the benefit of the community or other landowners he must be fairly compensated, and here he had to disagree with Mr. Harpur, who had said that the compensation should be based on the agricultural value of the land: this was clearly quite unfair, the market value at the time the land was taken should of course include prospective value. He referred to some instances of unfortunate planning in Cardiff which Mr. Harpur had especially pointed out, and explained the circumstances under which they arose. The great difficulty landowners and corporations had in such a town as Cardiff was to foresee the future necessities; and with every wish to make ample provision for the future, mistakes would inevitably be made. He instanced the case of a road at Roath Park that the corporation could have made as wide as they liked, but which they made 40 feet, and which was already found too narrow, as showing how difficult it was to foresee what developments might take place.

Mr. R. W. Cass (Farnham) agreed with Mr. Harpur that a fair but not inflated value should be paid to owners of land required for improvements under the Town Planning Bill, and also suggested that where it could be proved that such improvements increased the value of land, such for example as converting agricultural into building land, with a frontage to the proposed improvement, or otherwise materially increasing its value, such land should be made contributory to the scheme, or otherwise rated for the purpose. He had known cases where land having a market value of under one hundred pounds per acre, had, by reason of public improvements, been increased to a market value of fourteen hundred pounds per acre.

Mr. John S. Brodie (Blackpool), speaking with regard to the difficulty Mr. Harpur had in getting a suitable boundary between adjacent estates, said he thought that difficulty cropped up in almost every case. It was best to deal with the matter in a rough and ready way, and refuse to pass the building estate plans until the parties came to an understanding agreeable to the authority. Very often he was hard put to find a valid reason for refusing to pass the plans, but fortunately Blackpool possessed very comprehensive clauses in local acts

dealing with the laying out of new building estates, and in practically every case he had been able to get good street planning as between adjacent estates by encouraging a spirit of compromise on both sides. By sec. 53 of the Cardiff Corporation Act, 1894, it was provided that the Corporation should make compensation to all persons injuriously affected by the exercise of the powers of that section. There they had the crux of the whole question in nine out of ten cases of town planning. It often happened that by a little purchasing of land the Corporation could ease the strain between adjacent landowners to a considerable extent, and get good results if only they could acquire the land at a reasonable price. Mr. Corbett had stated a somewhat extreme view of the question from the landowner's side. Municipal engineers did not wish to associate themselves with any attempt to seize land below its proper market value. But what he would strongly urge was, that if, through The Royal Sanitary Institute, they could impress on the Local Government Board, in passing their present Town Planning Bill through Parliament, the desirability of simplifying the procedure of land purchase by municipalities, they would confer a great benefit on the community. Very often, in acquiring small areas of land for improved town planning, it is not the price paid to the vendor that is complained of, but the disproportionate cost of law, valuers, witnesses, &c., called by the vendor, all of which must be paid by the authority. It was desirable that the costs should be limited by an automatically applied scale, so that if the vendor chose to call a crowd of experts, he should do so at his own expense. He had studied the Government's Town Planning Bill carefully, and he thought there was not any clause in it which would help them in this.

MR. HARPUR (Cardiff), replying, said that in questions between a corporation and landlords matters might often be more easily arranged if left to the engineer on the one hand and the land agent on the other. With regard to Ninian Road, the corporation had spent a large sum over Roath Park, and it was for reasons of economy that the road was made only 40 feet wide; but as the corporation owned the land on one side of Ninian Road, and none of such land was built on, the road could at any time be widened without the necessity of acquiring any land whatsoever.

The Local Government Board was to blame more than any other body for the bad planning of many of our narrow streets and for the lack of open spaces. The Public Health Act, 1875, empowered local authorities to make by-laws, subject to the approval of the Local Government Board. That Board, however, provided them with a model set of by-laws; and what model had they set them? The model of a 36-ft. street and a 10-ft. backyard, in which latter there might be a privy and an ashpit, over which the air must pass which the people had to breathe.

MR. C. BROWNRIDGE and MR. SCOTT-MONCRIEFF also took part in the discussion.

NOTES ON HOSPITAL HEATING.

By C. H. COOPER, M.Inst.C.E.,

Borough Engineer, Wimbledon.

(FELLOW.)

THE following notes are given so that the question of heating hospitals erected on the pavilion system may be discussed by those having to deal with the subject. Although the notes are deficient in many important points, the author makes no apology for introducing a subject in which so many failures have occurred, as the sooner the more economic methods of heating are generally recognised the better.

Had research been undertaken at the public expense years ago, many hundred times the cost of such research would have been saved in the fuel which has been needlessly expended. Unfortunately, this research has been left to private enterprise, a slow and unsatisfactory means of solving the problem, especially where many of the ideas essential for economy could not be protected.

The following may be mentioned amongst the methods of heating adopted :—

1. *Hot Water.*—This, properly applied and where excessive encrustation does not take place, is economical, but its application is limited as—

(*a*) It does not contain available latent heat, so that its range of heating is small.

(*b*) It has to be generated at a level below that of the building to be heated, or pumps must be installed; and—

(*c*) It is difficult to ensure a proper distribution of flow throughout the different buildings.

2. *Steam under High Pressure* was introduced to obviate these objections as far as possible, but the result obtained involved the following loss of heat :—

(*a*) Leakage in the pipes and fittings due to excessive expansion.

(*b*) It necessitated the introduction of steam traps, in which a large amount of heat is wasted.

(*c*) Excessive radiation.

(*d*) In many cases the condensed water is not returned to the boilers, so that the heat it contained is lost.

(*e*) In addition to the loss of heat there is the reduction in the life of the pipes, especially those conveying condensed water.

(*f*) Excessive heat in radiators, and the difficulty experienced in regulating same.

3. *Steam at Low Pressure.*—The system that has been adopted for supplying steam at low pressure in this country is that known as the "Vacuum" system, which may be taken to include systems allied thereto. In this system the steam is raised at a pressure required for working engines and for disinfection, &c., whilst that required for heating is passed through a reducing valve in which the pressure is reduced to five pounds per square inch or less, the flow of steam throughout the system being insured by a vacuum pump or ejector at the end of such system. This is a much more economical method than that of high pressure steam, and has the further advantages that the

(*a*) Heat in the mains and fittings is not excessive.

(*b*) It almost dispenses with steam traps and the same loss does not occur in those used as in the case of high pressure steam, and

(*c*) It allows of automatic regulation of radiators, which is an important factor.

A system is being introduced which dispenses with the loss due to raising steam under pressure and that due to reducing such pressure. In this system steam is raised at the pressure required for heating, say 5 lbs. per square inch. This, however, necessitates a separate boiler for working the machinery and disinfection. I understand that the system is largely in use in Germany, but I do not know of an installation in this country. It has, however, been tried at the Indian Stores, Belvedere Road, S.W., and the results have, I understand, proved so satisfactory that it is to be used when these stores are rebuilt. In the case of Caxton House, which is, perhaps, one of the most economical examples of vacuum heating, it has been found that considerable economy is effected by heating the water required throughout the building in a separate boiler, rather than by raising the temperature of the water where required by calorifiers. This, probably, is due to a large extent to the loss of heat in calorifiers, which is, no doubt, mainly owing to the encrustation that takes place on the water side in the calorifiers.

I append a table showing coal consumption as far as I have been able to obtain them, but I may say that it is difficult to get comparative figures,

which shows the necessity for research which would give us figures comparing the coal consumption of the various systems when applied to the same building under similar conditions. At present, however, we have to infer that one system is more economical than another from figures given of such systems when at work in different institutions under different conditions.

LONDON COUNTY ASYLUMS.

COAL FOR YEAR ENDING MARCH 31st, 1907.

Asylum.	House.	Steam, excluding that used for lighting.	Total.	Per patient per annum.
Banstead	751	2,735	3,486	1·429
Bexley	749	2,053	2,802	1·318
Cane Hill	900	3,429	4,329	2·029
Claybury	922	3,055	3,977	1·225
Colney Hatch....	1,409	2,025	3,434	1·569
Hanwell	1,067	2,938	4,005	1·553
Horton	470	2,297	2,767	1·35
Manor	150	1,453	1,603	2·06
Epileptic Colony .	311	304	615	1·89

LAMBETH BOROUGH COUNCIL BATHS, KENNINGTON.

Year.	Coal consumed, in tons.	System of heating.
1904	1,433	High-pressure steam.
1906	1,035	Vacuum system.
1907	1,110	do.

MR. ARTHUR J. MARTIN (Westminster) said that Mr. Cooper had done good service in calling attention to the chaotic state of present-day practice with regard to heating. That was largely due to a lack of knowledge of the laws which governed the conveyance of heat. Mr. Cooper had compared the amount of coal used for heating purposes in public institutions with that in private houses, to the disadvantage of the former. In an institution, however, the use of indirect methods of heating was more or less obligatory, whereas their houses were warmed by radiation, which, besides being the most hygienic and comfortable method, was also the most economical. Another reason for the excessive consumption of coal in institutions was the large amount of air which was generally supplied to them. Our present practice in ventilation was empirical, being mainly based on certain assumptions of somewhat ancient date. He did not say they were supplying more air than was necessary, but the subject certainly called for further investigation. If the amount of air now generally supplied was excessive, any reduction would bring about a saving in the coal required for heating it.

MR. J. S. BRODIE also took part in the discussion.

ROYAL HAMADRYAD SEAMEN'S HOSPITAL, CARDIFF.

By E. W. M. CORBETT, F.R.I.B.A., F.S.I.

FOR nearly forty years previous to the opening of the New Seamen's Hospital at Cardiff, an old wooden man-of-war, The Hamadryad, moored in a creek or pill close to the site of the present building, had been used as a hospital for the seamen frequenting the port, and in spite of its being unsuitable for the purpose in every way, most excellent and successful work was done on the old ship, and when the new hospital was opened it was thought fitting to preserve the name and so continue the prestige and association of the old establishment.

It had long been the desire of those connected with The Hamadryad, a desire in which the late Marquis of Bute sympathised, to provide more suitable premises for this hospital, and when the year of the Diamond Jubilee, 1897, came it was decided that an effort should be made by the town to raise a fund to celebrate the year and to give a large part of it to the hospital; by this means, and by other subscriptions, sufficient funds became available to warrant the committee in preparing a definite scheme.

The Marquis of Bute gave a site in every way suitable as regards position, but rather a difficult one to deal with as it was overflowed by high tides, and thus required a great deal of filling.

Besides giving the site, the Marquis made a provision in his will for a sufficient sum to complete and equip the hospital: it thus became possible for the committee to push on with the new building and the work was placed in my hands.

The foundation stone was laid by the present Marquis of Bute, on August 7th, 1902, and the building was opened by him 29th June, 1905.

The ground consisted of about 19 feet of soft clay under which was good hard gravel. Much consideration was given as to the best and cheapest mode of making the foundation: eventually it was decided to carry piers of concrete down to the gravel, and to put a concrete lintel on those piers on which the walls were built. The foundation was necessarily very costly, and it was clearly desirable to have as little as possible, hence it became necessary to put the wards one over the other on three floors.

The piers, which vary in size, were arranged so that there should not be more than from three to four tons per square foot on the gravel foundation, or on the concrete in the piers. They were composed of cement concrete for the lowest 4 feet, and of lias lime concrete 5 to 1 for the remainder. The lintel was 4 feet deep by 3 feet 6 inches wide, composed of cement concrete 5 to 1. Where the openings between the piers exceeded 8 feet some iron rails were embedded in the lower part; under the side walls of the wards a continuous wall of concrete was put in.

The only material available for filling the site was clay from a new graving dock; this was rather soft and was troublesome, as it took a very long time to consolidate. The outer face which received the wash of the tide was partly pitched with stone and partly with cement concrete which is standing very well.

The walls of the superstructure are generally of rubble masonry faced with pressed Ruabon bricks for the street front, and cemented for the back portions.

The buildings consist of a doctor's house separated from the hospital, but with a covered passage leading to it: an out-patients' room, consulting room, dispensary, splint room, etc.; a small receiving room for the preliminary inspection of cases, and a room quite shut off from the rest of the premises for retaining infectious cases till they can be taken to the town hospitals for such. Kitchens, larders, stores, laundry, mortuary, operating theatre, Rontgen ray rooms, rooms for nurses, servants, and other officials are provided.

There are three main wards, each containing 16 beds, and three small ones adjoining, each containing two beds. At the entrance to the wards are the duty rooms or ward kitchens, linen stores, and general stores, and at the further end bath rooms, sink rooms, water-closets, large day rooms, 27 feet by 16 feet, and emergency stairs. There are 13 bedrooms, one sitting room, and a large general room for the staff.

A space of about four feet is left between the ground and the floor of the ground-floor ward, with a number of arched openings, to allow of a free circulation of air between the ground and the floor.

The ward floors are of concrete and iron, with a surface of terrazzo, the interior of the walls are rendered with Portland cement plaster, finished with Keene's cement, and painted with Gay's enamel.

The main wards are each 65 feet 6 inches long by 26 feet wide, and 12 feet high, and contain 16 beds each; there is thus 1,277 cubic feet per bed. The small wards are 21 by 16 feet by 12 feet high, and contain two beds, giving 2,016 cubic feet per bed. The wards are warmed by

low-pressure hot-water ventilating radiators, placed under each window, and fresh air is admitted through them, and there are also air inlets under each bed.

There are eight 18 by 9 inch flues built in buttresses to the outer walls for each of the main wards on the ground and first floor with entrances close below the ceiling for the extraction of the vitiated air, and for the ward on the second floor there are turret ventilators in the roof.

The corridors are also warmed by radiators.

The lighting is by electricity throughout, the current being obtained from the Cardiff Corporation.

The kitchen is fitted with gas and steam-cooking apparatus. An electric lift works from the corridor close to the kitchen to the duty rooms on each floor.

A bed-lift is provided in the well of the staircase; but this, as it is worked by hand at present, is too slow to be of much use, and should be fitted with electric machinery.

The operating theatre is detached from the other buildings, but is connected to them by a corridor. The block contains an anæsthetic or recovery room, 10 by 10 feet; an operating room, 15 by 15 ft.; a doctor's changing room, and small sterilising chamber. The walls are lined with glazed brick, and the ceiling of the operating theatre is of glass and enamelled slate. The doors are of teak covered with zinc, and the windows have iron frames. The whole of the operating room is constructed so that it can be washed down with a hose without injury.

A small mortuary, with *post mortem* room and viewing chamber is provided. The laundry is separate from the main building, but is connected thereto by a covered way. It is operated by hand. The fittings were supplied by Messrs. Bradford.

The cost of the building was as follows:—

Filling site	£1,693	4	3
Foundations	3,812	12	3
Superstructure, including heating, cooking, and laundry plant, lifts, architect's commission, &c. ...	22,106	12	5
Furniture	1,292	15	1
Surgical instruments, &c.	306	7	6
Total	£29,211	11	6

Taking the cost of the superstructure, only £22,106, which includes

turfing the site, forming paths, fencing, and concrete pitching, this gives a cost of about 9·7d. per cubic foot and about £409 per bed.

Mr. Luke M. Hill (British Guiana) asked why the openings for the extraction of vitiated air should be placed under the ceiling, when we were led to believe that vitiated air, containing large proportion of carbonic acid gas, was heavier than ordinary or pure air, and would therefore materially gravitate towards the floor level?

Mr. H. A. Garratt (Torquay) being concerned in the construction of piles and piers under water, inquired if any means had been provided for examination of the foundation of the structure, especially in connection with the use of *lias lime* concrete in the piers, and what had been the result of such examination: also, had any settlements become apparent in the walls of the building?

Mr. E. W. M. Corbett (Cardiff) said that before adopting terrazzo floors to wards inquiries were made at many institutions where it had been used, as to its being cold, tiring for the nurses, etc., and the answers were so favourable that it was adopted, and proved very satisfactory, bright and cheerful in appearance, and easily kept clean.

He had been asked if the lime concrete piers were standing well, as salt water was injurious to lime concrete, and replied that these piers were surrounded by solid impervious clay and that the salt water could not affect them; that he had no reason to doubt they would last, that much lime concrete had been used for foundations in the dock walls at Cardiff in the past and had stood well, and that the lime there was of a very fine hydraulic quality.

The position of air outlets had been discussed and fought over for very many years, and though he had no doubt the ceiling was the right place, he felt nothing he could say would affect the opinions of those who held the contrary view, and therefore he had put the outlets near the ceiling. The windows were constructed with double hung sashes in the lower part, and with sashes hinged to the transom and opening inwards, with side hoppers in the upper part.

Mr. J. Osborne Smith, Mr. C. H. Cooper, and Mr. J. S. Brodie also took part in the discussion.

COUNTRY SCHOOLS.

By DAVID PUGH-JONES, F.S.I.,

County Architect (Eastern Division), Glamorganshire.

(MEMBER.)

IT appeared to me that a few notes on small country schools or schools erected in rural districts would be of some interest, and lead to a useful discussion.

It may be an easy matter to express an opinion as to the most suitable soil, best aspect, etc., for a school site, but it is quite another matter to get an ideal site, or in some instances any site at all: and when a piece of ground is fixed on the price asked is often very excessive, if not prohibitive. In addition, the local education authority is often required to erect fences, construct roads, paths, bridges and sewers, which are a very costly item in this district.

The very uneven and steep gradients of many sites adds to the cost per head of the school, and makes it more difficult to prepare a good plan and form suitable large playgrounds. In many instances large sums have to be expended on retaining walls, subsoil drainage, etc., and a portion of the grounds are rendered useless as playground in cuttings and embankments.

To meet the exceptional increase of population in Glamorganshire the Education Committee very wisely buy or lease more land for each school than is immediately required, but this naturally adds to the first cost. When, however, additions are made the cost per head will be materially reduced.

Although half an acre of ground is allowed by the Board of Education for 500 scholars, it appears to me to be insufficient, especially when organised games are part of the curriculum, and as country schools are nearly almost always of one storey the amount of playground is naturally less per head than when two- or three-storey buildings are erected.

PLANNING.

Whichever method of planning is adopted, the central hall, the semi-detached hall, or the corridor system, the general arrangement should be

as simple and direct as possible with all parts well-lighted and ventilated.

The central hall may be made use of as an assembly hall for special instruction, lectures, or drills, and as a means of assisting the ventilation of the class-rooms, particularly in the winter, as fresh and warmed air could be admitted through the central hall. Glazed screens between some of the class-rooms and the hall assist the lighting, and with folding glazed partitions a larger hall is obtained for special purposes. When no hall is provided, folding partitions may be used between the class-rooms, and so a large hall may be obtained at a reduced cost.

The special advantage of the corridor system is that separate entrances are provided for the rooms. This avoids the objection of having to pass through one class-room to another, as in many old schools.

The Staffordshire Education Committee has adopted a plan without a central hall, with open verandahs between the class-rooms, and a detached or semi-detached drill hall to serve all departments. Another plan has been adopted by the Derbyshire Education Committee with a high corridor and folding partitions. In both the class-rooms have windows on each side and are no doubt well lighted and ventilated.

A room should be provided for the teachers and for the medical inspection of scholars.

Class-rooms.

The number and size of class-rooms depends to some extent on the size of the school. No class-room should accommodate more than 60 scholars, but a class-room to accommodate from 30 to 50 is the best if cost allows it.

A good shape for a room is that approaching a square with the fireplace on an inner wall facing the scholars at one side either near the door or near the windows; the latter is best, as this would not compel the teacher to stand in the draught between the window and fireplace. The central part of the wall opposite the scholars should be kept clear for the teacher's use. In our schools the class-rooms and central hall floors are invariably formed of solid rift sawn wood blocks, on concrete.

A black-board about twenty-one inches wide is generally provided round the rooms and halls in the upper part of the dado for scholars' free-arm drawing, and is made of boards, slate, cement, or plaster painted a suitable shade. A revolving black-board is provided for the teacher's use. It may be fixed at various angles and height, and special matter may be retained on one side while the other side is being used. These are provided in all our new schools, as well as some of the old schools.

Dual desks are provided for all scholars, with tables and chairs for the younger ones.

All ordinary classroom floors should be level.

Classroom windows should, as far as possible, have south aspect.

Cloak-rooms.

Cloak-rooms are best placed near the entrances, separate ones being provided for boys, girls and infants. Rails should be at least 4 feet apart and in two tiers. I consider that from 15 to 18 inches should be allowed between the hooks for girls' hats and cloaks, which only means 8 to 9 inches hanging space for each scholar, while 9 inches between the hooks would be sufficient for boys' caps. The fittings should be of iron coated with enamel or aluminium paint, which keeps very clean.

The walls should be faced to a height of about 4 feet 6 inches with glazed brick or tiles. The rooms should be well lighted and cross ventilated. Strong wire netting should be provided in the upper door panels to improve the ventilation. Doors capable of being locked should be provided to prevent the clothes being stolen by tramps and others. The floor should be formed with terrazzo, cement, or tiles.

Sanitary Conveniences, Drainage, &c.

For schools where a public water supply and sewers are available water closets are provided and are of a modern type. Children old enough to attend school should be capable of pulling the chain to discharge a flushing cistern, and so separate pedestal closets should be provided for all scholars, and not trough closets. The pedestals should be from 12 in. to 14 in. high, with large water area and a good seal. Closets may be 2 ft. 6 in. to 2 ft. 9 in. wide, with a door cut short at the bottom and at top, and a fanlight over and cross ventilated. The divisions should be about 6 ft. high and 3 in. above the floor, and may be of slate slabs with glazed bricks or cement facing to the walls.

Many schools have no public water supply or sewers within a reasonable distance, and so pail closets, such as Moule's earth closets, have to be used. These should be regularly attended to and kept clean. A good sanitary glazed earthenware casing under the seats to hold the pails is now on the market, but adds somewhat to the cost. Pails are, I think, better than the standard earth closets designed by the late Mr. Sylvanus Trevail and allowed by the Board of Education.

Urinals should be lined with impervious materials, such as glazed slabs, cement, or slate, with a channel along the walls, and a perforated flushing pipe fixed about 3 ft. 6 in. high; slate divisions reaching to the ground are objectionable, and make it difficult to keep the urinal clean.

The floors should be formed of impervious material with as few joints

as possible. Where no sewer is available the urinals and lavatory wastes may be drained into a water-tight cesspool, ventilated, and provided with a movable cover.

All soil drains should be laid on concrete and well ventilated.

Water Supply.

Many schools have no proper supply of drinking water, and the water has to be collected from roofs or pumped from wells and stored in tanks. Stored water is never satisfactory and is always liable to contamination. Drinking water stored in tanks should be filtered through such filters as the Pasteur Chamberland. In some of our schools water from the public mains has to be stored in large tanks in consequence of the irregular and insufficient supply.

Warming and Ventilation.

The ordinary methods in use for heating are the plain grate of the Leamington Bar type, warm air ventilating grates, warm air stoves, and low and high pressure hot water. The open fireplace is no doubt cheerful and materially assists ventilation. In old schools I find the grate is often set too far back in the wall, and the brickwork set sloping away from the fire. With a heating apparatus fireplaces may be used for special occasions. Where there is no heating apparatus a warm air ventilating grate, such as Boyd's or Wright's, gives satisfactory results. Open fires are always provided for infants. Warm air ventilating stoves give out a considerable amount of heat, but should be fixed nearly flush with the wall. They are not so cheerful as open fires. To both the warm air grates and stoves a fresh air supply flue should be provided.

Nearly all our new schools are heated by hot water low pressure system with pipes and radiators: this is less dangerous and more uniform than the high pressure or steam system. Pipes in channels covered with open gratings should not be allowed. Boilers of the sectional type work very satisfactorily. A minimum heating surface of 16 feet per 1,000 and 60° F. inside when the temperature is 30° F. outside is always demanded.

Ventilation is probably the most difficult problem not only for schools but for other buildings. For small if not for all schools the best system appears to be the natural system. An extract flue in the chimney stack is useful, but it is not sufficient in itself. An extractor should be provided in the ceilings, carried out through the roof by means of air-tight shafts connected to roof or ridge extractors. The ceiling vent is necessary when no cross ventilation is provided and the ceiling coved: but when windows

are provided on both sides, as in the Staffordshire and Derbyshire type of schools, this does not appear necessary.

Inlets may be provided by having a large number of the windows to open at both top and bottom. The upper portion should be made to open on centres, and the lower part of at least one of the windows fitted with a hopper about 15 to 18 inches high, with passable glazed hopper cheeks such as the N. A. P. and Hill's, so as to allow the sash to fall on the window board when necessary, and the lower part of the other windows should be fitted with sashes in boxed frames or hoppers. Wall inlets with outer gratings and inner regulating louvre inlets may be provided. The outside grating should be built lower than the inside in order to prevent rain, etc., blowing in, and to direct an upward air current. With a level ceiling and high windows to open on two sides of classrooms, I hardly think a ceiling outlet would be necessary.

I find all window fittings provided with cords troublesome, good rod openers being far more satisfactory.

Lighting.

Every part of the school should be well lighted. Ordinary class-rooms are best lighted from the left windows and should be well distributed, with the tops reaching as high as possible to within a few inches of the ceilings.

Central halls, if used as art rooms, which is often done in higher elementary schools, should have a northern aspect.

All windows should have clear glass equal to one-fifth to one-sixth of the floor area. Often less than half of this was found in non-provided schools, the minimum amount asked for by the County Council was two-thirteenths for old schools.

For artificial light, gas is used, where possible with incandescent burners, or electric light. A large number of schools, however, have to be lighted by oil lamps. The light should be well distributed over the rooms, but kept more to the left hand of the scholars.

Infants are not taught by artificial light, but a light for the cleaner's use is provided. 2½ to 3 candle power per scholar appears to be a fair amount, but as most, if not all, artificial light burners deteriorate, particularly incandescent mantles, it is advisable to allow a little margin.

Playsheds or shelters should be provided to all schools, with a sunny aspect.

All schools should be provided with some simple gymnastic appliance.

There are quite a number of cookery kitchens attached to schools in

my division: in some instances the kitchens are used as centres for more than one school.

Manual instruction workshops are provided at several schools, chiefly as centres.

All secondary or intermediate schools for boys are provided with manual workshops.

At present a number of higher elementary schools are being erected and designed in my division for various populous areas. All are provided, in addition to ordinary classrooms, with lecture room, laboratories, art room, manual instruction room, and cookery room, as well as other necessary rooms.

Baths.

I think that baths of some kind could be added to large elementary schools, as well as higher elementary and intermediate schools, with advantage, and in many cases at a small cost.

It may be interesting to know that various Welsh mottoes are adopted for most, if not all, of the new schools, such as:—

Ymdrech a lwydda (Perseverance will succeed).
Goreu arf, arf dysg (The best weapon, weapon of knowledge).
Gwell dysg na golud (Better knowledge than riches).
Gwybodaeth sydd nerth (Knowledge is power).
Ni lwydd ddoeth ni ddysgo (He that will not learn will not be wise).
Nid byd, byd heb wybodaeth (No world, a world without knowledge).
Cam goreu cam cyntaf (First step, best step).
Ni wyr, ni ddysg (He knows not who learns not).

Cost.

The cost of elementary schools varies considerably according to size, area, and suitability of site, distance from railway station, etc. Schools of the central hall type may cost anything from £12 to £20 per head. One of the chief reasons of this great variation in cost is the expense of preparing the sites and heavy foundations in this district. Schools on the corridor system are generally less expensive than the central hall type.

The cost of additions is sometimes disproportionate to the cost per head on account of the amount expended on work which does not add to the accommodation.

[*For Discussion on this paper, see page 513.*]

THE VENTILATION OF SCHOOLS.

By REGINALD G. KIRKBY, A.R.I.B.A.
(MEMBER.)

THE object of all true education should be to make intelligent labourers, craftsmen, merchants and good citizens, and the conditions under which our children labour should be such as to assist them in every way in the attainment of this object.

Whilst of late years much has been done to improve the curriculum, administration, lighting, cleanliness, etc., of our schools, yet very little progress has been made with their ventilation.

Of the many causes which bring about mental fatigue, lassitude, headache, inattention, so often noticeable in children towards the close of the day's studies, there is none perhaps which contributes more to this end than the want of proper ventilation.

I recently visited a new school of the central hall type in Middlesborough, a town whose death rate from lung diseases is very high. On entering one of the classrooms that had just been vacated, I found the air so foul that it caused me to draw back and I noticed that no attempt was made to change the air by opening the windows or in any other way, and the children were allowed to again occupy the room under these very unsatisfactory conditions and were expected to do justice to their studies.

My attention was then drawn to the natural system of ventilation, and I have since examined and tested a number of buildings in various parts of the country supposed to be ventilated on this system and found—

Where several ceiling outlets were connected together by metal tubes and led into a so called central extractor, there was a danger of foul air being drawn from one classroom and carried along the tubes and delivered through what was intended to be the foul air outlet into another room for the children there to breathe over again.

I believe Dr. Scurfield, Medical Officer of Health for Sheffield, made some tests in Sunderland a few years ago with somewhat similar results.

Fresh air inlet wall tubes fitted with regulating traps were very often closed and sometimes filled with paper and rubbish, and the flaps being out of sight had been forgotten.

In very cold weather, owing to the heating of some schools being so deficient, every fresh-air inlet was closed in order to keep the room warm. The same often applied to ventilating stoves, which were closed and had been forgotten.

Inlet metal gratings in outer walls were of such design that the metal closed the opening at least 60 or 80 per cent.

Down draughts from the ceiling foul-air outlets, connected to so-called roof extractors, were often complained of: and in some cases gas jets had been placed in the tubes, but these were not sufficient to cause a proper draught. Regulating flaps had been placed in the ceiling outlets; these had been closed to prevent down draught, and had remained so.

In some cases hinged automatic closing valves were used to prevent down draughts, and these would sometimes "go wrong": and in one new school, not twelve months old, every one had "gone wrong," and was closed and had been for some time.

To avoid interfering with the appearance of a building by putting in a number of roof turrets, "secret ventilators" were often used, and for the sake of appearance the children's health was made to suffer, for the very name of "secret" ventilator implies its uselessness.

From my observations, and the recent tests made by experts to ascertain the state of the air in the class-rooms, I am led to believe that many, if not most, of our modern schools are inefficiently ventilated, and a radical change will have to be made to make them efficient.

A mistaken belief in the powers of the many appliances which are now put on the market and illustrated in well got-up catalogues is partly responsible for this, and too much reliance is placed in so-called roof extractors which trade under the assumed name of ventilators: in some cases they would be better called fresh air inlets.

Dr. George Reid, County Medical Officer of Health, Staffordshire, recently made some tests to ascertain the quality of air in schools built on the central hall type and those of the pavilion system now being erected in Staffordshire and Derbyshire. The tests showed the air to be very much purer in the Pavilion schools than those of the Central Hall type, and even better than in the Plenum ventilated schools. The standard of purity in the central hall schools was very far short of that generally recognised.

From the complaints made in the Central Hall schools it would appear that from a ventilation point of view they are not the most serviceable kind of building, and even from an administrative point of view many head teachers have led me to believe that little importance can be placed

on the idea of having the head teacher's desk in sight of all the class rooms.

It is to be regretted that this type of building has been so extensively erected before its efficiency has been proved. No doubt the rules of the Board of Education in recommending it in their "principles to be observed in planning and putting up new buildings" has led many architects and others to adopt it in order to get their plans approved, there being no other course apparently open to them.

The arbitrary manner in which the Board of Education have dealt with those who suggested improvements in the planning and ventilation of schools is much to be regretted, and the opposition which the Pavilion system met with from this body does not reflect much credit upon it.

By ventilation, we do not mean putting into a building certain appliances either mechanical or otherwise, but by passing through a building sufficient fresh air to maintain it in a state of purity to the general comfort of the occupants. The different systems of ventilating schools may be described as follows:—

1. Natural Systems.

(*a.*) By means of fresh-air inlets in walls, and in ventilating radiators and stoves fitted with regulating flaps. Foul-air outlet openings in ceilings connected by means of tubes to so-called roof extractors either on the ridge or concealed. This system, which appears to be largely adopted, will be known to most of us by its failures and want of system, and thereby want of ventilation.

(*b.*) The open-air system, such as may be found in Germany and at The Cloisters, Letchworth, where really no ventilation in the ordinary sense takes place. Whilst this type of building has many advantages from a hygienic point of view, and at present it is more or less in the experimental stage, it has great possibilities, and I think will come rapidly into use when we are most earnest on this question. The result of this type is that sufficiently warm and completely fresh air is supplied to each student without the danger of it becoming vitiated.

(*c.*) Another system, somewhat on the lines of the first one, as regards inlets, and having the foul-air outlets in the ceilings connected to a roof turret by ducts formed of wood framing and plaster.

The turret is fitted with an inner framing, the openings of which are covered with silk cloth flaps which remain closed on the side of the wind, and easily open with the current of air passing through the ducts. An outer framing is fitted in the usual way with louvred openings to protect

the inner from the weather. The system has proved successful, but is capable of improvement.

(*d.*) In some cases an iron flue from the heating chamber is placed in an upcast shaft, which draws the vitiated air from the class-rooms by means of ducts with outlets at ceiling and floor levels. The fresh air is warmed by being passed over the heating apparatus, and is delivered at about eight feet from the floor level. This is more elaborate and pretentious than most natural systems, but has met with some measure of success.

(*e.*) In the counties of Staffordshire and Derbyshire new types of schools on the pavilion and corridor systems have been built to ensure the cross ventilation into the open air of all class-rooms, which appears to be the most natural and successful way of dealing with this question. The tests in these schools, taken by Dr. Reid, show the air inside to be practically as pure as that outside.

This system of ventilation is by means of hoppers and sash windows with ventilating radiators on both sides of the room. The ordinary ventilating appliances are omitted. On the coldest days in winter some of the hoppers are kept open with no discomfort to the scholars. The fresh air inlets provide six or eight times the area usually required by the Board of Education. It has been necessary to slightly increase the heating surface on account of the larger quantity of fresh air admitted. In these schools a system of thorough cross ventilation is obtained, and so a natural system of ventilation exists.

All sorts of difficulties were raised by the Board of Education when the plans for these schools were submitted, and it was only after a deputation had waited on the Board that permission was obtained to put up the buildings, which have undoubtedly proved far in advance of those built on the principles recommended by the Board. Although several of H.M. inspectors have visited these schools privately, yet, I understand, no official approval of them has been given.

2. Mechanical Systems.

A number of schools have been ventilated on various mechanical systems, but I think the initial cost and cost of upkeep is too prohibitive for schools excepting in special cases, and could only be used with advantage in large towns where the air is laden with dust and dirt. On this account, and owing to the limited space, I have not dealt with the mechanical systems.

There may be some excuse for keeping windows closed where the air is laden with soot and dust and requires moistening, but even then

buildings should have their windows made to open. It does not seem natural to teach children to keep windows closed as the ideas learnt at school are carried into the home, and they should rather be taught to keep windows open and obtain as much fresh air as possible.

Among the buildings of this class which I visited was one recently erected in London for higher educational purposes. Outlets were placed near the ceilings, connected by ducts to a large extracting fan on the roof, and although the fan could be heard working in the rooms below, yet no upward movement of the air was noticed, although I tested it in several ways and in a number of rooms. I entered the rooms immediately after an examination had been held and found it quite a relief to pass out into the open air once more.

The question often arises as to whether schools can be properly ventilated so as to maintain a recognised standard of purity without incurring great expense. The Staffordshire and Derbyshire types show us that this can be done, for the amount of added impurity in the schools only averaged ·23 CO_2 per 1,000 c. ft.

My object is not to attempt to calculate the velocity of air passing through certain sized openings, or to say whether the CO_2 to be found in class-rooms is greater at the ceiling or floor level. Whilst I have gathered statistics on these and other interesting questions, I have purposely omitted them, and hope rather to show that there is something radically wrong with the ventilation of many of our new schools, and to appeal for an inquiry to ascertain the best means of making them efficient. What I think we want to consider is, how to supply our class-rooms with plenty of fresh air, so as to scour them as often as possible during occupation.

I would suggest—

(1.) That school teachers be scientifically taught the necessity for keeping the air of the class room in as pure a state as possible, the proper use of regulating fresh air inlets, and the need for opening windows on every possible occasion. (*a.*) For the sake of the children, to enable them to obtain the maximum benefit of the teaching from an educational point of view. (*b.*) For their own sakes, to guard against the lung and throat diseases and excessive death-rate which teachers are liable to. Teachers should understand that fresh air will prevent the spread of disease and the growth of organisms which thrive in closed rooms.

(2.) That a standard of purity be required rather than certain fixed rules as to cubical contents. Any amount of space can be had in a room, and yet the air can be as filthy as it is possible for it to be.

(3.) That all class rooms be so designed that windows or hoppers, etc., be made to open, and so arranged as to thoroughly scour the room in a few minutes, with inlets well distributed. The more inlets there are the less draughts will be felt.

(4.) That qualified inspectors be appointed to examine all schools and to regularly test the air to see that the standard of purity is maintained, and that efficient inlets and outlets are provided and to keep charts of their observations. Such inspectors should be directly under the medical officer for the district. This work should be done by men having a knowledge of school building, and not left to those who have been appointed by virtue of their having previously held some Government appointment in another capacity.

(5). That the heating arrangements are such that a reasonable temperature shall be maintained without resorting to extraordinary stoking of fires or boilers.

Here, again, too much reliance is placed on the heating capacity of certain makers of hot water and other fittings. It must be remembered that children often come to school in a half-clad condition, and in consequence the want of proper heating has led to the closing of all fresh air inlets which might have been left open had the temperature of the rooms been raised to ensure a state of comfort.

A great deal depends upon the surroundings of a school, and not enough attention is paid to the selection of its site. Committees often choose an unsuitable site, and then invite architects to submit designs, which, at the best from an aspect point of view, leaves much to be desired.

The question of the ventilation of our schools requires the serious consideration of those who are interested in them. It is only by collaboration with medical experts that architects can expect to arrive at a satisfactory solution of this question, and find the most suitable means of making our school buildings healthy and really efficient; school-masters may also be consulted with advantage. It is singular that schools are designed and erected from stereotyped rules without even consulting masters in any way, as so often special requirements, peculiar to the locality, may be entirely overlooked.

The experiments recently made in Germany to provide open-air schools for teaching physically unfit children, and those who are backward (not on account of defective intelligence), point to the necessity of supplying the children with as much fresh air as possible during teaching hours. As yet, however, the difficulty of successfully coping with the requirements during winter when the snow is on the ground has not been fully

overcome, but the good results show that it is not necessary, even in a climate like ours, to bottle up children in classrooms, whose air is vitiated, to secure efficient tuition. The reason for this is that we treat fresh air as an unwelcome guest in our homes, and avoid the least draught as likely to bring us all the ills that flesh is heir to.

To-day hundreds of new schools are being erected in various parts of the country, many of them probably with no real ventilation at all, and in these buildings our children will have to labour under most unhealthy conditions. May I urge for a more natural environment. What we want in our classrooms is more fresh air; nothing can equal it, and there is plenty of it to be had.

[*This Discussion applies also to the paper by* MR. PUGH-JONES, *p. 501.*]

MR. J. OSBORNE SMITH (Westminster) said he heartily welcomed the papers as indications of the thought and attention now being given to subjects which have in the past been more or less neglected. Bearing in mind the difficulties in the way of securing healthful surroundings and occupations for young children in large towns and cities, it becomes increasingly important that the time they are inside the school buildings should be passed under the best possible sanitary conditions, and every precaution taken to secure a healthful environment.

To obtain that effectively, it was necessary the teachers should have some knowledge of sanitation and of the physical necessities of vigorous childhood, as well as of the ailments of children.

Mr. Kirkby had referred to some elementary schools being built in Staffordshire; these were a step in the right direction, because, being designed upon the plan of a hospital for infectious diseases, ample provision was made for perflation of air in both summer and winter, and special attention was given to warm the incoming air thoroughly. In those schools the hall was a separate building for the joint use of boys, girls, and infants: it was warmed and ventilated in a similar manner to the class-rooms. Economy was claimed for that scheme with its single hall instead of three, and it would be interesting as an experiment even if the joint use of the hall should not prove to be quite satisfactory in the future.

The real difficulty in ordinary elementary schools, especially those with central halls, is to obtain adequate perflation; the teachers cannot secure it in winter with the means at their disposal without running the risk of danger to the children and to themselves. The incoming air in most elementary schools is not adequately warmed, and in many no provision whatever is made for warming the incoming air: it usually enters *only* through vertical shafts or fanlights near the ceiling, and no air comes in at all when those are closed in very cold weather. He was not concerned to defend the central hall plan, but he was sure that if suitable means were adopted to obtain perflation and the generous admission of warmed air, the interior of schools built upon that plan could be made healthy and comfortable.

Mr. E. Y. Saunders (Barnstaple) said he noticed that Mr. Pugh-Jones advocated the use of separate pedestal closets in preference to trough closets. He rather disagreed with this, especially where infants were concerned.

With a good type of trough closet, such as was manufactured by the well known makers, all risks of nuisances might be avoided, by good flushes at short intervals, but the separate pedestal closets gave many opportunities for undesirable conditions arising owing to children, either negligently or forgetfully, omitting to flush. He would value further information from Mr. Pugh-Jones on the following points:—

1. Did he prefer the central-hall plan to the corridor system?

2. Did he pave playgrounds with an impervious surface, or leave them simply gravelled?

3. Did he cover in any portion of the playground for provision in case of wet weather?

4. Had he found it desirable to have folding partitions made by firms who made that work a speciality, or did he intrust this work to local labour.?

5. In warming by the hot-water low-pressure system, did he advocate the one-pipe or two-pipe plan?

Mr. J. Philip Jones (Holywell) said that up to a recent date the success of elementary schools depended almost entirely on the pupils passing certain examinations, but things had changed, and examinations in some measure were disregarded, almost everything depending on attendance, with the result that the whole power of education committees was brought to improve the attendance of schools, and this had been accomplished to a remarkable extent, and in many cases the attendance reached from 85 to 90 per cent. It had also been ascertained that children in rural districts had to walk on an average over half a mile to school, and children must often arrive at school with their outer garments wet. These wet garments were piled together as a rule, and the children, after being in a warm and comfortable school for three hours, put on these wet clothes and caps, and probably were in them for half an hour or more. Could they conceive of anything more dangerous to children's health? Inasmuch as the authorities compelled attendance, irrespective of weather, it was only right that such proper means should be provided for the drying of children's clothes in elementary schools as was done in secondary schools. This could be done by an enlarged cloakroom, with heating arrangements which could be attended to (involving but a trifling expense) by the school caretaker.

Mr. Pugh-Jones, in reply, agreed that teachers should be more thoroughly trained in the principles of ventilation: unless the teachers had some knowledge of ventilation it would be difficult, if not impossible, to properly ventilate the rooms; and also that cloakrooms should be thoroughly ventilated as well as heated, particularly for girls and infants, as they invariably left more clothes in

the cloakroom than boys. The new cloakrooms in his division, as well as in his colleague's, were made airy, and well heated when an apparatus was provided.

He thought the central hall system with at least one side open worked very well, and up to the present appears to be the best for this country. A very large number of new schools, and extensions to existing schools, had been carried out by him during the last few years; in no case had the teachers or inspectors complained of the ventilation; a very large portion of the windows, top and bottom, were made to open, and the fittings provided were easy to control.

He found the natural system of ventilation, when properly applied, worked most satisfactorily, while in many cases he found the mechanical systems a failure.

He had inspected the silk flap system mentioned under heading *(c)* in the paper, and was of opinion that it was a failure. At the time inspected, though quite new, a number of the little flaps had been turned up in order to allow any air to pass, and the ducts from several rooms were connected to the central turret, a system condemned by the author in another part of his paper. Even the practical system of ventilation, like everything else, required some attention, and when the teachers were capable of giving this, after the architects had supplied the proper means, he thought there would be very little room for complaint.

As to water-closets, a large number of all kinds were in his division. He thought that the best and most economical were the separate cisterns and pull for each closet; with the automatic system a large amount of water was often wasted and the closets were very foul during some portions of the day; if the trap got choked, as it often did, the whole range of closets was useless.

MR. R. G. KIRKBY (Cardiff) said that he could not agree with Mr. Smith's contention that to put hopper windows into schools of the central hall type would make their ventilation efficient. He could take Mr. Smith to schools of the central hall type where these hoppers had been introduced, and where the ventilation was very deficient; the teachers having also complained of the stuffiness of the rooms. He said it was entirely a question of planning, and not so much putting certain appliances, whether hopper or other windows or roof ventilators, into the building.

The central hall type of plan was very far short of being ideal or suitable for schools, particularly from a ventilation point of view, and it was surprising that it had been so universally adopted before its efficiency had been proved.

A radical change in school planning was necessary, in order to make the schools fit for the children to work in.

MR. W. D. SCOTT-MONCRIEFF also took part in the discussion.

LIGHTING OF SCHOOL BUILDINGS.

By G. TOPHAM FORREST, M.S.A.,
Architect to the Northumberland Education Committee.
(MEMBER.)

AS medical opinion is practically unanimous that short sight is greatly aggravated by working in badly-lighted rooms, I offer this short paper for the purpose of discussing this important phase of school hygiene.

Dr. Kerr, in a paper recently read on the medical inspection of school children, made the following remarks:—

> "Another subject taking an important place in the public mind, so important, indeed, that local education authorities frequently consider it an isolated matter, is the vision of school children. Ten per cent. of school children in large towns have bad vision; the percentage is lower in country districts. A considerable part of this is due to various catarrhal conditions and is eminently preventable, but a good deal is also due to nervous strain. The subject has been fairly well understood for thirty or forty years past, but still it is supposed that spectacles are the remedy for each child. Very few children really require glasses or ought to need them: the things wanted are *well-lighted school buildings*, clean windows, suitable furniture, and suitable desks."

With reference to Dr. Kerr's remarks, two statements are indisputable:

1. A large percentage of the children in our schools have defective eyesight.
2. The cause has been traced in part to the schools.

These facts should be sufficient to create amongst school architects a keener sense of their responsibility in regard to the eyesight of school children.

It is my intention to touch upon the principles involved in lighting applied to a new building, and more especially to discuss the architect's part in the remodelling of old buildings, and to lay before you some suggestions as to the best classroom windows which may, perhaps, afford a field for discussion.

A combination of three requirements is necessary for the proper and efficient lighting of a school: (i) the selection of the site, (ii) the requisites of the architecture and equipment, and (iii) the teacher's duty. With reference to the last, it is important that the teacher bear in mind that

he has an interest and responsibility in connection with each of the subdivisions. He may have no hand in the choice of the site or in the planning of the building, but, unless he knows the principles involved, he is almost certain to violate seriously the requirements of school hygiene as applied to the lighting of classrooms.

The Selection of the Site.

The value of high ground for the school site is inestimable; it insures good drainage, and more light by reducing the height of the obstructions and giving a freer play to the sunlight, the influence of which secures immunity from dampness. The building should be placed so that it is possible for each child to see the sky from his desk. The control of trees should be secured with the purchase of the site. If they do not interfere with the lighting of the building, well and good; but this point should be carefully considered when inspecting suitable ground. The question how to secure sunlight for all the rooms during some part of the day has led to considerable discussion as to the best direction for a building to face. Buildings should not be placed so as to coincide with the points of the compass, otherwise the north-side rooms, if lighted on one side only, are cut off from the sun, while south rooms may get too warm in hot weather. To avoid this the building should face the middle points of the compass. By this arrangement each side receives the sun at some time during the day. A frontage of this sort makes south-east rooms most desirable, south-west next, then the north-east; and the north-west is least to be desired, as the effects of the sun are only felt after the children have gone for the day. These distinctions, however, must not be carried to an unnecessarily fine point; but when such a site can be obtained as readily as another, it should be given the preference.

If a building is so planned that it is impossible to secure the sun for each room, the deficiency should be made up by increased heating and ventilation. Having determined the character of the building, be careful to put the light in the rooms used for school work. This, of course, is the mandate of common sense, but how many times do we see that these considerations are not always regarded, *e.g.*, assembly halls put on the south side, teachers rooms monopolise windows which should go to light classrooms, and staircases are often to be found on the side of the building having the best light.

Amount of Window Space.

The relation of window space to floor space should be at least one to six; this ought to give the minimum of defective eyesight. Knowing the

amount of window space required as compared with the floor space, the next problem concerns the location of the light. Here two considerations are involved: (i) the full light must shine on the children's work, (ii) the light must not be faced by pupils or teachers.

The conditions are fulfilled by adequate lighting from the left, and it must be borne in mind that the light from the highest part of the room is by far the most valuable. That which comes through the lowest panes goes to the floor. No shadows are cast by left-hand lighting. Light from behind, however, casts shadows on the books from the head and body of the pupil. Light from the right is obstructed by the pupil's hand, and there should be no light facing the pupil. For reading purposes front lighting is exceedingly bad, as the light is thrown on the binding of the book instead of the page. Of all possible combinations of bilateral lighting, that with windows on the left and right is much to be preferred. This form of lighting is very often seen in small country schools; only care should be taken that the lighting from the right hand should be shaded, leaving the chief source of illumination from the left. Light from the left and rear is particularly trying to the teacher, although from the pupil's standpoint alone the left and rear lighting is usually better than right and left; for, as a matter of fact, the children furthest away from the windows on the left get from that direction not only the light from windows on that side, but even the light from most of the rear windows comes to them from the left.

In furnishing a classroom seats should never be placed close to the windows; the last desk nearest the wall facing the teacher should always be in a line with the side of the window opening, and not be placed in the shadow of the wall.

Width and Structure of Windows.

So many varieties of classroom windows are in vogue, both as regards design and construction and having regard to the ventilation of the classroom, that it will be sufficient here to outline a few of the main principles which determine their use. It is well to remember, when designing windows, that the light should enter the room as a unit, so that there will be no distinguishing cross lights, no distinctly outlined shadows, and one light will shade into another without any visible lines; in other words, there should be no broad piers or mullions between the daylight openings. On that account I am not an advocate of planning classrooms having only two windows, as this necessitates a considerable width of wall surface between them. I am of opinion that the best and most suitable form of

classroom window for an ordinary sized room (to accommodate, say, 50 or 60 children) is a three-light one, but it is hardly possible to construct brick piers of sufficient strength in a building of any height that will not interfere considerably with the light.

Eighteen inches seems to be the minimum width usually adopted, but as this width throws a shadow on the desks nearest the window, cast-iron mullions, I believe, are now used (although I have not seen any). These are cast with heavy webs and with the window frame bolted directly to them. In this way it is possible to put the windows sufficiently close, and at the same time provide sufficient strength. When brick piers are used, these should always be bevelled on the inside.

The Ceiling and Side Walls.

The plastering should diffuse the light. It should therefore be tinted some very light colour, almost white. Blinds are essential when a room is exposed to the sunlight, but these should never be made of heavy or dark material. Dark blinds will ruin the whole system of lighting. A light sage is a very satisfactory colour, or cream.

When the style of window will permit, two blind rollers should be hung at the centre of the windows, each fitted with blinds, one being pulled up and one down, so as to screen the whole window.

In furnishing a classroom special care should be paid to securing school desks of practical construction. The eyesight of the pupils may be seriously impaired if the desks are made too high or too low, and the advantage of having a good building may be counterbalanced by this mistake.

Some little time ago the writer was called to report very fully upon the question of adjustable desks for secondary schools, and some valuable statistics were volunteered by various principals, who all agreed as to the necessity for grading the heights of the desks in a classroom to suit the pupils. In a classroom of a secondary school three sizes are commonly met with, and in my opinion some such system would be advantageously applied in the furnishing of our elementary schools. The failure to adjust the desks to suit short-waisted children is a neglect of duty to care for the eyesight.

The architect's part in the remodelling of old buildings is an important one. A judicious application of the following questions might do good:—

(i) Are all obstructions, such as buildings, trees, etc., cleared so that the children will not be deprived of seeing the sky?

(ii) Is light put where it is wanted?

(iii) Is the ratio of window glass to floor surface one in six?

(iv) Are the windows on the left side, or in such combinations that the children will not be compelled to face the light?

(v) Are the tops of the windows more than six inches from the ceiling?

(vi) Have all large piers between the windows been done away with?

Light from the Wrong Direction.

This defect can be easily overcome by an adjustment of the desks; left and front light can be easily changed to left and rear. Right and front light can be changed to left and rear, and so on.

The Teacher's Duty.

It has been stated that the most perfect architectural plans will not make the children immune from defective vision without a more decided co-operation on the part of the teacher. Some teachers do not co-operate with the architect in his scheme for the lighting of the rooms. This is often shown in a careless and ignorant manipulation of the blinds, especially in the cutting off of high light, or in a failure to attend to the varying conditions of sun and cloud.

TESTING OF DOMESTIC DRAINAGE.

By Major J. J. GALLOWAY, R.E.

IT is incontestable that the condition of domestic drainage affects the health of the community very directly, and yet it is very difficult to ensure its satisfactory state, even with modern precautions and inspection during construction, as drains, when once covered up, are so inaccessible and they are constructed of such comparatively fragile materials.

As during my military service barrack works and repairs have fallen to my lot to a greater extent than more purely military duties, I have from time to time uncovered the drains of many barracks, finding every defect referred to in text books and a few others besides.

I have not had many opportunities of inspecting domestic systems in civil buildings, but those few I have seen were below the standard obtaining in barracks.

For a good many years past every new or re-laid drain in barracks has been tested by water in the presence of an engineer officer and a medical officer, who both sign a certificate as to its soundness, this certificate being guarded for reference. In some military commands the principal medical officer insists on the inspection being made by a medical officer possessing the D.P.H. The smoke test is prescribed if water test is impossible. Personally I always test underground pipes up to ground level by water before the soil and ventilating pipes are fixed, testing these later by smoke; though as a rule I have considered an inspection of these sufficient in the first instance, and have found medical officers agree with me. An instance which I came across about seven years ago makes me doubt whether this omission is desirable. My private opinion is that it is all right if full weight pipes are used.

In practice very considerable divergence of opinion exists as to the standard of soundness that should be insisted on in new work. At a station abroad where I did a good deal of drainage reconstruction the sanitary officer would not sign the certificate unless the fall in water level in the manhole at the head of the length under test was inappreciable during the time taken in flanching the pipe (already laid on concrete) with concrete and in filling in and ramming. The manual lays down that a certain amount of absorption, soakage, and sweating of joints is

unavoidable. Fortunately at this station I had a labourer in my employ who had acquired such skill in manipulating the cement in the joint that he could unerringly attain this difficult standard.

In civil practice a severe smoke test is in many cases considered sufficient for new drainage. It is excellent for discovering direct escapes of gases from the drains to the house, the most dangerous defect, but in the case of underground stoneware pipes, even if applied before filling in, it may fail to detect defects which may develop into leaks beyond the extent which may safely be permitted.

The tests of drains are designed to prove the absence of two dangers. the escape of foul gases into the air surrounding and in our houses, and the escape of foul liquids into the soil near the foundations of the houses. The former is realised by the lay public, and is well revealed by the smoke test. In the absence of means of access to the drains the water test cannot be applied, and though the danger of leakage into the soil is not overlooked, the danger is not fully realised in the absence of evidence of its existence.

My barrack experience convinces me that stoneware pipes close to buildings rarely remain satisfactory for long, and therefore that they should only be provided when they can be periodically tested from manhole to manhole. A stray leak into soil may do no harm, even in a congested district, but if they are numerous the effect is more or less cumulative. My barrack experience leads me to believe that leaks are more frequent than is generally believed.

Stoneware pipes, and those of kindred materials, are liable to many accidents when laid underground. They are easily broken by subsidence of the ground, especially if laid without concrete bed or flaunching, and they may be crushed by heavy traffic. But the most probable injury (at least, in my experience) is that of damage by workmen excavating the ground after the drains are laid. When manholes are scarce Y junctions are plentiful, and in spite of the abundant variety of different degrees of bends stocked by dealers, flanges are split by the use of pipes of unsuitable curvature. In the drainage of cavalry barracks, which I uncovered almost throughout within three or four years of its being laid, not a single Y junction was uncovered which was not split in this way. Clay joints, no joints, and half joints manage to creep in unless superintendence is very reliable. These are detected at once by the water test, but may stand the smoke test.

As regards iron soil pipes, I have never come across a defect in material or jointing in the case of heavy pipes weighing 60 lbs. to the 6-ft. length of 4-in. pipe, with lead joints run and caulked. The W.D. manual

lays down that soil pipes must be of this weight, but prescribes medium pipes of 48 lbs. to the 6-ft. length for ventilating pipes above the w.c. trap. Caulking a lead joint in a 48-lb. pipe is liable to split it, and red lead joints are generally used, though a joint of rust cement is suggested as an alternative. I found abroad that a hot sun dried up a red-lead joint in very few months, and after a bad case of this proposed to use rust cement, but before the next work some cases of 48-lb. pipes split by the heat of the sun were discovered; so that at that station I ever afterwards used 60-lb. pipes with lead joints for the full length of a ventilating soil pipe. I have been informed within the last few days that the London County Council now prescribe a 54-lb. pipe for ventilating purposes which safely admits a caulked lead joint. This is so near the 60 lbs. that there is little use in having a separate section, especially for places abroad where the multiplication of patterns of stores is a thing to be avoided.

Three cases which I have observed illustrate the comparative effects of leakage under different circumstances.

In the first case the barracks had a bad sanitary reputation, cases of enteric, diphtheria, and diphtheritic sore throat being fairly common, to judge from a spot map in my office. The drains, when uncovered, proved to be of very ancient type, the mains being square brick laid in bad mortar, and the more modern branches of 4-inch pipes fairly riddled with pick-holes. The buildings were of old type, and very few had internal sanitary conveniences of any description. Only the staff officers' quarters had w.c.s in the house: the married soldiers' quarters had no sinks; all latrines, cook-houses, and other buildings with connections to carry off waste were apart from dwelling-houses. While I was at the station all the cases of illness were in the houses provided with w.c.s, and, as the internal fittings were sound, the cause must have been in the leakage of gases and liquids from the riddled earthenware soil pipes. All pipes were surrounded by a layer of blackened soil, the black of decomposed facal matter. The soil was heavy, but not impervious, and allowed soakage, though possessing no oxydising power. The most extraordinary discovery made was the course of the drainage from the officers' quarters. A square brick drain ran the length of the buildings, with 4-in. pipe connections to the houses. The fall was very flat, I should say from recollection not steeper than 1 in 200, and at the end the drain ran into a square catchpit, which was connected with a 9-in. drain which ran back underneath the brick drain, but at a steeper slope; another catchpit took the sewage, which then entered a 12-in. pipe drain running at a lower level than and parallel to the other two and the same direction as the first. This pipe dipped with an increasing slope. When we reached about 12 ft. below the surface and the pipe was dipping

at about 45°, I asked for further instructions. The outfall was never found, the town did not know of it, and rather than continue a hopeless task the barracks were vacated, and I believe are empty to this day.

The second case was in the same town, and though the drains were almost as defective the health of the troops was good. There were some square brick drains here, but they had been abandoned at an earlier period, though not removed. The drains in use were pipes of large size, not less than 12-in. diameter, with open butt joints. There were no bends used, change of direction being made by leaving the pipes open at the outside of the curve. There was no blackening round the pipes, in spite of the ample opportunities of escape, and I connect this absence with the general good health of the inhabitants. The clay was impervious to water, and prevented the escape of sewage matter. These cases occurred in 1895 or 1896.

In the third case, which occurred in 1905, the health of the troops was excellent. The drains had been completely relaid less than four years previously under the direction of a specially appointed clerk of works. I was unaware of this fact, and when it was one day reported to me that a kitchen was overrun with rats, knowing the barracks to be old I suspected the drains and proceeded to test. A complete system of manholes was found, but on applying the water test the water ran away as fast as it was poured in. The whole of the drainage in the barracks was found to be defective, and had to be relaid after four years at a cost of several hundred pounds. When the drains were relaid one thing was done thoroughly, and that was the removal of the polluted soil. The records of tests could never be found, and one can only surmise that the officers who should have made the tests were too busy owing to increased duties consequent on reduced personnel during the war, and the highly paid and trusted clerk of works cannot have made more than a perfunctory inspection of the work. Testing cannot have been done at all, as many joints had no trace of cement. The soil was a light gravel, and though the leakage had been enormous, there was a complete absence of blackening of soil. It is to this I attribute the good health of the troops. The soil had great oxidising power which might have continued for a few years longer, but in the end the condition of the first case would be reached.

It is a subject of biological research as to what quantity of leakage soil can be dealt with, keeping in view the fact that it has no chance of aeration. From this could be worked out the permissible drop in level in a manhole in a given time.

[*The Proceedings of the Congress will be continued on page 545.*]

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CONGRESS AT CARDIFF.

CONFERENCE OF MUNICIPAL REPRESENTATIVES.

ADDRESS

By Councillor JAMES ROBINSON, L.R.C.P.,
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PRESIDENT OF THE CONFERENCE.

CARDIFF is the metropolitan city of a country whose hospitality is on all occasions proverbial, and it would ill accord with our past history if I failed not only to greet you warmly, but also to recognise that those before me are responsible in quite a serious degree for the sanitation and general physical well-being of the great mass of people in the land.

If we are as a nation to achieve even a modicum of success in the administration of all those concerns which vitally affect the people's health, it is almost redundant to add that the administrators must themselves be enlightened individuals with high ideals, progressive intuition, and a sound sense of the grave responsibility resting upon their shoulders.

Municipalities may be prepared to furnish lavishly the funds necessary for continuous advancement, and local conditions may be altogether favourable, but if those in authority are ignorant of the march of progress expenditure will have been incurred in vain.

The assembly of this Conference and the fact that it is so largely representative, demonstrate that there is a keen desire to live and learn, to profit by experience, to gather the quintessence of wisdom from the papers read and speeches made upon them: all this I say is undeniable evidence that the responsible authorities are alive to the great trust reposed in them.

It is, I am convinced, primarily because you are desirous of making

the environment of the masses more generally satisfactory than it has ever been before, that you are visiting the city, and Cardiff welcomes you most heartily and wishes you God-speed in the onerous task of dispensing sweetness and light.

The casual word of wisdom, the statement of expert belief, the unrivalled germ of experience from men who have studied and carried out solutions of the great problems confronting us, must ultimately reach localities near and remote and have an ulterior beneficial effect of transcendent value.

The paramount need of the times is still to educate the people to the fact that they can make or mar their own surroundings, and if they can once be got to see that the great medicines of life are fresh air and sunshine, there will not be the slightest difficulty in obtaining all the support we require to carry on our campaign against filth and disorder, the eradication of noisome slums, to open up wide avenues permitting the air to circulate freely and the sun to penetrate its salubrious and invigorating beams.

We, at any rate, have long ago arrived at the irrefragable conclusion that health and longevity are fostered by closely following certain guiding elementary principles, and these must be tenaciously held in the face of any and every opposition, however powerful and mistaken it may be. Sometimes there is a prevailing air of despondency at our limited rate of progress, but we must take heart and wage incessant warfare against all vicious agencies detrimental to the public weal.

The Press and our own knowledge teach us we are steadily advancing, gaining adherents as we go, and more readily reaching those whose ignorance is ofttimes a greater curse than their unfortunate poverty.

It is a potent fact that in the decade ending 1860 the urban death rate was 24·7 per 1,000 and the rural rate 19·9, a difference of 4·8. In 1906 the urban rate was 16·88 and the rural rate 14·42, a difference of 2·46, and it is remarkable that in this year there was only one death per 1,000 of the population of London higher than in the country districts. This furnishes ample demonstration of the beneficent application of sanitary science, and should encourage us to more strenuous efforts.

If it is important to learn to die, it is equally important to learn to live, and if I bemoan one thing more than another it is that the forces, necessarily influential, at work in the domains of religion and education do not raise their voices so loud, nor so long, nor so often as they might in the direction of exhorting and teaching the people to sweeten their

daily life. Ministers and teachers, who have unrivalled facilities for telling the masses and guiding the young as to their plain duty in the matter of domestic hygiene, could well strengthen this side of their noble work without sacrificing in the least the spiritual and educative side.

If the home is unclean and the neighbourhood a den of squalor with no brightening influence whatsoever, the natural result, proved to be true in actual practice, is to resort to other places where maybe the gloom is lightened and the tendency to depression dispelled. There is a close organic connection between the sanitary side, on the one hand, and the moral and spiritual on the other, hence I urge, as strongly as I am able, the prime necessity for all to lend a hand in the task of uplifting, and to save the wanton and ignorant from committing crime against their own health.

There is indeed need of the gospel of the simple laws of health. Let all the streets of a densely populated city be spacious, the houses of the best tenemental type, let each have a broad and airy garden, yet our efforts will be in vain without the essential element of personal and household cleanliness. More cohesion is necessary between all the workers in the cause of enlightenment, and it is a moot point whether there ought not to be statutory powers to rigorously prosecute filthy people for personal or domestic neglect when their conduct becomes, as it inevitably must, a prolific source of danger to others.

We have reached the stage when festering and crowded slums must be wiped out, regardless of temporary inconvenience and cost. These are a pestiferous menace to great communities all over the country. You may provide unlimited parks and open spaces as lungs, widen your main and branch thoroughfares, cater in the best degree for two-thirds of your population, but if of the whole area the remaining one-third consists of rookeries, this is an all-potential source of evil.

In this connection the Bill which the President of the Local Government Board has recently introduced is one fraught with splendid possibilities of great communal value. The Housing and Townplanning Bill, which gives local authorities large powers to build houses for the working classes, grants to cities the right to compulsorily acquire land on which to erect suitable and cheap dwellings, and prevents the land falling into the hands of speculators and jerry-builders, is certainly one which must interest health committees, entirely apart from political consideration. It is a long-deferred reform which ought to save extra suburban districts from the loathsome overcrowding which has long played such havoc in the towns.

It must not be forgotten that there is a much greater tendency now than formerly to get into the suburbs which are rapidly extending almost everywhere. If we can deplete the congested areas and map out the virgin land on sensible and intelligent lines, we shall be doing invaluable work for the housing of the future. Some of our colliery villages in South Wales are glorious models of "How not to build," and it is positively depressing to traverse them, so ugly, insanitary and altogether objectionable are the lines on which they have been developed. Yet land was plentiful.

Cardiff's comparative modernity and rapid growth have saved it from any extensive slum area, and it is without the wretched excrescences that handicap many cities of similar size. Yet if Cardiff had been laid out in advance, so to speak, and its development had taken place on certain definite lines well thought out, it is easy to conjure up in the imagination a veritable garden city, with infinitely better and healthier facilities, without appreciably extending the area for the same density of population.

Without some central authority to dominate the situation the haphazard growth of to-day must be perpetuated, and it is because Mr. John Burns's Bill is likely to reach the statute book, that it is well we should watch its progress with an exceedingly friendly eye, and I feel confident to be called upon to administer some of its provisions in the near future. With this some measure of land reform is indispensable, and then we may hope to go forward on our campaign of progress with greatly accelerated speed.

I have already said that our local conditions are favourable and the open spaces numerous and well governed. Still we are a cosmopolitan community with representatives of all nationalities thronging at our doors, and you will understand that it is very essential we should continue to take advantage of every opportunity for improving our sanitary equipment. Dr. Walford, the medical officer of health, is well known to a large section of the Congress, and you will easily believe that under his guidance we endeavour to keep well abreast of the times. The vital statistics published by the health committee speak well for what has been done in the immediate and distant past, and I will not bore you with figures further than to say that the death rate per 1,000 from all causes in the decennial period ending 1861 was 29·2 whilst in 1907 it was only 15 per 1,000.

It may be interesting to note that 100 or so years ago the city was a mere hamlet, with the tide ebbing and flowing where the most central thoroughfares now stand. Owing to the contiguity of the coalfield with

its unique treasures, and the splendid nautical position of the port, rapid development was well nigh inevitable. One hundred years ago the population was barely 2,000, to-day it is over 180,000.

It is a great distributing centre, sending an almost priceless commodity all over the world.

Thanks to the prescience and enterprise of the Bute family, its docks have increased and multiplied at a prodigious rate, and last year His Majesty the King opened the Queen Alexandra Dock half a mile long, one-fifth of a mile wide, and capable of holding easily the biggest ships in the world. One of our most prosperous shipowners estimates that the dead-weight capacity of our fleet of 300 steamers, together with sailing vessels, is upwards of 1,000,000 tons, and if other ships trading from Cardiff, though not owned locally, are taken into account, it is likely that two millions would be the more correct figure, and this represents about one-tenth of the tonnage of the Empire and one-twentieth of that of the world.

With all these facilities and huge traffic Cardiff is destined to grow, and it is perhaps not an empty boast to claim for it quite a leading place among the cities which make up the empire. Unquestionably the progress is phenomenal, and when the deferred extension of the boundaries, ultimately inevitable, takes place, the need for the most vigilant foresight in everything appertaining to health is apparent.

We have tried to realise fully the necessity for most carefully dealing with isolation in all forms of virulent infectious diseases. In addition to a typical general sanatorium, we have long possessed a refuge for cholera patients on the Flat Home Island, out in the Bristol Channel, and there, too, is located a miniature crematorium for the disposal of bodies whose transport through the city might be inimical to public health.

Dealing with the dead, I feel it incumbent on me to say that the hedged-in location of our cemeteries (I am not speaking of Cardiff alone), consequent upon the progress and development of towns, constantly raises a very serious problem, and the time is rapidly coming when we shall be compelled to consider the position. Cemeteries surrounded by houses are not very sentimental. First of all the land immediately adjacent to populous centres is urgently needed, and health considerations point at any rate to the advisability of locating them much more remote from towns than they frequently are.

The most sanitary and effective means of disposal of our dead is

unquestionably by cremation, and it is a pity public opinion is not more quickly ripened for a change that is practically certain to come.

Attached to the Cardiff Health Committee is a full complement of sanitary officers, two trained nurses fully occupied, a bacteriological and analysing department, and all the necessary impedimenta for the efficient equipment of everybody concerned.

In common with other localities we have recently made provision for the medical inspection of school children, and in connection therewith engaged two medical assistants, one of whom is a lady practitioner, and both are added to the staff of the medical officer of health. Here again the new departure is one which must be most highly commended on the ground of aiding the physique of the nation. We are merely following in the wake of Germany and America, and such a step was indispensable after the report of the Committee on physical deterioration. I think we must not too hastily conclude that it will sap parental responsibility, for the practical result is quite in a contrary direction.

There is little doubt that in the past eye-sight has been permanently weakened, teeth ruined, verminous propagation assisted, predisposed tuberculous constitutions irretrievably shattered, and children with infectious maladies allowed to mingle too freely with their fellows for the want of adequate early attention. We rightly cry out over the diminishing increase of population, yet have unfortunately allowed those who were born to be ofttimes massacred in their infancy or pine away before the adolescent stage has been reached. The system of trained nurses advising the mothers how to suitably rear their offspring will bear good fruit, and so undoubtedly will the medical inspection of the child if remedial measures are expeditiously adopted.

Unfortunately the Board of Education, whilst theoretically stimulating education authorities in this direction, has fallen short of the desideratum by neglecting to provide increased financial assistance to meet the new expenditure, which cannot fail to be heavy if the inspection is, as it ought to be, thoroughly carried out. The tendency naturally is to limit the cost at the expense of efficiency, and however socialistic I may seem, logic will compel the provision of sufficient money to pay for medical treatment in the minority of cases where parental conditions are synonymous with poverty.

Remedial measures must be pushed home, and if the inspection is to be merely what has been aptly termed a sort of annual stock-taking it is only a few degrees above useless. My own opinion is that if the

Legislature empowers education authorities to provide food and sue for reimbursement where circumstances warrant, it should do the same where expert investigation has diagnosed the disease, but parental neglect failed to find the remedy.

This is exactly where we stand, and we are liable to lose the fruits we ought legitimately to reap. The indigent and neglectful sections of the community are largely propagating the race, and they must be strung up to concert pitch if the submerged element is not to impoverish the future manhood and womanhood of the people.

Here, too, I should like to put in a plea for the effective use of the recent Act dealing with neglect of children by drunken and dissolute parents. I am glad to say that the chief constable of Cardiff is very alert to its usefulness, and many cases have been dealt with. Where the home is transparently neglected, and the children verminous and ill-clad, wide powers of inspection for months together have been utilised, and special police officers told off for the duty.

Many such parents, shorn of all sense of human dignity and responsibility, have received a salutary lesson where preliminary warnings have failed. The children have been removed, and both parents, when the neglect was common, have received six months' imprisonment at the hands of the stipendiary magistrate.

The subject of tuberculosis is of course by no means novel, but it cannot unfortunately be overlooked. Time and again it must be reiterated that it is largely a preventive disease feeding on unorthodox conditions of life. The effects of the scourge can generally be mitigated where hereditary tendency prevails, and altogether obviated in normal cases. What we want is not to provide sanatoria but to stamp out the malevolent causes. No word of mine shall depreciate the sterling value of the many institutions for aiding consumptive cures. We all glory in their effectiveness, whole or partial, but their chief value is to point the way to live the most beneficial life. They cannot always cure. The only safe cure is prevention, and again housing and fresh air play the most prominent part. It is a startling though undeniable fact that counties typically rural with a sparse population provide their quota of consumptives, and the only belief is that cramped-up cottages, badly lighted, and worse ventilated, produce all the necessary conditions for the initiation of the disease. There appears to be a laudable tendency to cope with the malicious habit of expectoration in both public and private places, and it is quite time the indiscriminate dissemination of bacilliferous sputum was terminated, and

if necessary the strong arm of the law vigorously applied. The bacilli so prevalent in the sputum must be comfortably housed in the pocket flask under any and every circumstance.

Quite recently, I am glad to say, I was able to persuade the health committee to provide these receptacles for the indigent amongst our Cardiff patients, and the cost is so small that every sufferer should use one for the sake of his family and the public. The afflicted have our full sympathy and help in their calamitous visitation, and we must have their full co-operation in limiting the fell complaint to the narrowest possible circle.

A matter of outstanding import with which we have as yet only touched the fringe is the milk supply, and full powers of inspection and control must be vested in municipal authorities from the grazing of the cow in the field until the milk reaches the house. The air teems with micro-organisms, and it is most urgent that we should guard such a susceptible medium as milk from any germs of a pathogenic nature. The dairy sheds are a great source of pollution, and the only place I can imagine free from infection are the magnificent buildings we are about to erect in connection with our new Mental Hospital. There the cows are to get the most princely accommodation, and we are setting a very high standard for the country.

The milk supply is of the very first importance, and I seriously question if we have as yet fully realised the part it plays in the national stamina. While tubercle bacilli are of rare occurrence in meat it has been conclusively proved that they are a never-ending source of danger in milk, and when, moreover, we reflect that the highest percentage of death of children occurs in the first twelve months of their life, and that their food is so very largely, unfortunately, cow's milk, the need for the most scrupulous care is self evident. Municipal milk depots seem to be growing in public favour, and this in spite of the fact that they incur a considerable loss to the ratepayers.

Time prevents me dealing with our water supply, which is ample, pure, and within reach of all. Nowhere in the country is this commodity more generously available, and the responsible committee and officials are deserving of warm congratulations for their constant foresight and expeditious effort when needed.

I have alluded to the highly valuable nature of the work of trained nurses, and reverting momentarily to the question of infants, I would like to add that our officials give oral advice and leave printed cards of instruc-

tions when these appear necessary after notification of childbirth. In cases of tuberculosis, too, regular inspection and aid are afforded, and I am inclined to think the last decade is chiefly notable for the recognition gained for the great usefulness of the work done by these municipal servants.

I am of opinion that it is advisable to repeatedly bring under review all matters of transcendent municipal concern, our responsibility as sanitary administrators does not end with to-day, for we are quite equally the guardians of posterity.

The work of research is making very fast progress, and it is our duty to take ample care that the results of these labours are practically applied when they are likely to be beneficial. When we recall how sanitary science has annihilated some of the malignant scourges of the past, it ought to embolden us to face the future with a determination to baffle by ingenuity all the ills and maladies which after all only flourish through our own imperfections.

The health of a community is always a matter of highest national interest, and if we, as the custodians of the people in this respect, take full advantage of the powers now so generously placed in our hands, we may assuredly hope to keep pace with the needs of concentrated masses of our fellow beings, and make their environment worthy of our boast as one of the most enlightened and civilised races in the world.

NOTIFICATION OF BIRTHS ACT.

By WILLIAM ARCHIBALD, M.D.Glas., D.P.H.Camb.
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THE Notification of Births Act, 1907, came into force in Glasgow on January 1st, 1908. The Act provides for the notification of still as well as of live births. Its scope, however, is limited to notification only, but the information thus obtained affords local authorities an opportunity of getting into closer touch with the causes of infantile mortality, and also of arranging schemes of visitation, which will bring to many mothers who could not otherwise obtain it, some counsel regarding the conditions which imperil the lives of their children.

In Glasgow the number of live births registered annually exceeds 24,000. The number of still births is unknown, but taking the notifications under the Act for the three months, April to June, 1908, these are equal to about 2½ per cent. of the number born alive.

On the numbers registered during 1907, the notifications under the Act should amount to 25,000, or about 80 per working day.

Every birth which takes place under the charge of the family medical attendant may be excluded from any scheme which it is deemed desirable to adopt for the purposes of the Act. At the moment we have no precise knowledge as to the number of births thus attended, but again taking the three months, April to June, 1901, the figures work out as follows:—

5,903 births were notified (*i.e.*, 23,612 per annum, or practically all the births occurring). Of these, 2,198 were notified as having been medically attended, but in addition 246 were found on visitation also to have been attended by medical men. This is equal to about 42 per cent. of the whole, leaving 58 per cent. attended otherwise. In Liverpool, Manchester, and Birmingham, fully 60 per cent. of the births in 1906 were attended by women who are mostly certified midwives practising under supervision, while in Leeds, on the contrary, 50 per cent. of over 1,200 births, occurring in one of the poorer districts, were medically attended either at home (41 per cent.) or in institutions (9 per cent.).* In Cowcaddens (one of the poorer districts of the city) and its neighbourhood, of 1,460 births in 1906, 79 per cent. were attended by women.

* This information was obtained from the medical officers of health of the cities named.

Taking the three months quoted, less than 60 per cent. of all the births occurring required visitation. The requirements of the several wards, as is seen by the 79 per cent. stated for Cowcaddens, vary enormously, and energy should be expended where it is most required. This suggests a selective scheme of action and a combination of agencies which may be adapted to the varying requirements of individual wards. It need be uniform only in its minimum requirements, but should provide in the worst districts for the greatest frequency of visitation.

In Glasgow the scheme adopted accomplishes the following:—

(1) A minimum scale of visitation by the female officers of the Department to every mother not medically attended at the birth of her child;

(2) Supplementary visits to those where the need for further supervision is obvious; and

(3) In selected wards or districts of wards where the death-rate is uniformly high, such frequency of visitation as may be accomplished by voluntary agencies similar to those already working in some of them.

All these agencies, whether official or voluntary, are under the direct instruction and supervision of a lady medical assistant.

CO-OPERATION OF MIDWIVES.

In giving effect to the first part of this scheme it is apparent that a powerful auxiliary might be found among the midwives themselves, could we enlist their co-operation. The department would thus be brought into touch with a very large number of births at the time of their occurrence, and advantage to both mother and child would most probably result.

It should be noted here that the midwives in Scotland are under no supervision whatever at present, and their practices vary considerably.

The better sort would, I believe, willingly acquiesce in the proposal, and some instruction might be given them which would tend, I think, to yield some of the advantages which English cities possess in the Midwives Act.

More, however, will be required, and for all the sections of the scheme indicated it will be essential that a card be prepared for each birth not medically attended, on which certain details will be inscribed. This is a part of the work which will best be undertaken by the health department itself, and preferably by visitors who may have occasion to make visits for other administrative purposes, the multiplication of visitors to individual houses being, I believe, undesirable.

In the districts selected for special effort under Section III. of the scheme the birth cards would then be passed on to the voluntary workers.

In the remaining districts only such households as come within the description in Section II. would receive continued attention.

The first visit would thus in all cases be made by a staff visitor, and this I believe not only desirable, but in a certain manner essential to obtaining full advantage of the Act.

The districts in which effort at special supervision should be made will obviously be selected from those which present the higher infant death-rates, and it will be better to concentrate attention at first in selected areas than to attempt to cover a larger field in a less complete manner.

The extent of supervision, *i.e.*, the frequency of visitation and the number of infants included therein, will depend on the number of social workers who volunteer for the work, for it must be recognised that without voluntary assistance in this part of the work the information supplied through the Act cannot be utilised to the best advantage.

Indeed, we know from our own experience and from a knowledge of what is being done elsewhere, as well as from the opinions expressed in the Committee Rooms in the House of Commons when the Notification Clauses of our recent provisional Order were under discussion, that the argument for obtaining the present Act was considerably strengthened by the knowledge that local authorities would find their efforts to reduce the present wastage of infant life willingly seconded by organisations of social workers. It is upon these organisations we must now rely for the detailed supervision which the selected districts will require.

For while the saving of infant life will form the primary object of the visitation, it will be found impossible to deal with it as a detached factor in domestic life, and the personal influence of an educated and sympathetic woman brought into intimate contact with so many of her poorer sisters cannot fail to operate for good in directions beyond the original object of the visit. It may readily indeed afford one of the most powerful influences for social reform which has yet been attempted.

The number of infants which one visitor may undertake will vary with the time at her disposal. From 4 to 20 per visitor represent the maximum variation which experience suggests as consistent with reasonable frequency in visitation, save where children are brought by their mothers to the "infant consultations," of which we have now five in Glasgow.

The interval between visits will be guided by the needs of the particular household and the time at the disposal of the visitor. There is, we are ascertaining, a not inconsiderable tendency to have recourse to artificial feeding during the second month of infant life, and the causes of this require investigation. For the first three or four months of life, therefore,

monthly or even fortnightly visits may be desirable in some instances, while, save in particular cases, those made after the sixth month may be at much longer intervals.

It will be desirable also that the voluntary visitors in each district should work under the direction of a lady superintendent, and conferences with the medical staff should be not less frequent than monthly.

Training.

No standard of training for this work can be insisted upon at first beyond a familiarity with the requirements of district visitation among the poor, but as the organisation develops new visitors could work along with those more experienced, until they have become familiar with the questions likely to require attention.

No reference has hitherto been made to the request of the Home Office for information regarding the effect on infant mortality of the industrial occupation of mothers, because this will incidentally be obtained in the scheme just outlined.

Alderman A. Wilson (Newcastle-on-Tyne) expressed dissatisfaction with the Notification of Births Act, and thought all the benefits required would be met by the Registration of Births Act, and that the greatest good for the benefit of the children and prevention of mortality was to be got by the house being visited later, when as a rule artificial food and "a bit of anything that was going" was given to the child. The Bill only gave power to notify, and not to enter the house, and as "an Englishman's house is his castle" we had no more right to trespass on a poor man's house than we had on a rich.

Councillor Wilson (Lancaster) said that the Act had been adopted in Lancaster because it was felt that its adoption would greatly assist the lady health visitor in visiting cases immediately after birth, as in many cases she would not otherwise receive the information till the child was nearly 6 weeks old; the birth and death of many children being registered at the same time. Their experience of the first quarter's working of the Act was that only about twelve cases were unnotified. They did not prosecute in those cases, but gave notice that future cases would be dealt with according to the law. The result of the adoption had been that our health visitor had been able to give such early advice as they hoped would have in time great effect on infantile mortality.

Miss Eva H. Jones (Bradford) said that the Notification of Births Act, apart from its more obvious advantages, was particularly useful as a means of dealing with ophthalmia neonatorum. Many of the present midwives were hopelessly

ignorant, and owing to inattention at the time of birth a number of infants lost their eyesight.

In the City of Bradford this Act was adopted in January of the current year.

Out of seventy registered women five only were fully trained, many being unable even to write, yet 60 per cent. of the births were attended by midwives.

Since the adoption of the Act in Bradford all such cases were immediately visited by one of the women inspectors, who paid especial attention to the condition of the mother and eyes of the infant, and wherever necessary persuaded the parents to obtain medical advice. In that way, in a number of cases, those early visits had been the means of saving the eyesight of several infants, and if for this reason alone the Act had already proved its value to the State.

Councillor Lawson (Leeds) said that no doubt a very large proportion of the cases of blindness were due to the neglect of the child at birth. In Leeds they had a number of lady inspectors, and found them of the greatest assistance. There was unfortunately a prejudice against lady inspectors amongst a certain number of people; he ventured to hope that those people would learn better. But he would like to point out in this instance the importance of establishing a high standard of lady inspectors: they were the proper people to visit a house where a birth had taken place. He believed that a large proportion of children born were healthy at birth. He cordially agreed with Miss Jones upon the value of ladies visiting houses where a birth had taken place at the earliest possible moment.

Dr. S. G. Moore (Huddersfield) pointed out that the need of the Notification of Births Act arose from the fact that the Registration Act failed to acquaint the health authority of the existence of the child in time to prevent the excessive mortality occurring at the very earliest ages. Although some infant deaths were inevitable, others were preventable, and the Act was a useful means to that end. He gave statistics bearing on the working of the Act in Huddersfield (where it originated), and concluded by pointing out a substantial reduction of the infant mortality figure there, which he ascribed, in part at least, to the working of the Act and the consequent measures which it rendered possible.

Alderman Windley, Dr. O'Donnell and Dr. Archibald also took part in the discussion.

CONSTRUCTION AND MANAGEMENT OF CREMATORIA.

By C. KILLICK MILLARD, M.D., D.Sc.,
Medical Officer of Health, Leicester; and Medical Referee to the Leicester Cremation Authority.
(MEMBER.)

IT is not proposed to consider the arguments for and against cremation, but to deal with the administrative aspect of the subject. It may be taken for granted that cremation has come to stay. There is a not inconsiderable and increasing section of the public who have a definite and unmistakable preference for cremation, believing it to be a more sanitary, more scientific, more enlightened, and less objectionable method of disposing of the human body after death than the existing practice of placing it in the ground, and there leaving it to the slow, offensive, uncertain, and often insanitary process of natural decay.

It is true that cremation is still far from popular. The number of persons cremated annually, though increasing, bears only a very small proportion to the number who are buried. From the point of view, however, of social position and intellectual distinction, these persons are by no means a negligable quantity.

At the present day, then, a demand for cremation exists, and it is right that in large centres of population facilities for it should be provided.

The number of British crematoria at the present time is thirteen. Five of these, the Hull, Leicester, City of London, Bradford, and Sheffield crematoria are municipal enterprises (local authorities being authorised by the Cremation Act, 1902, to spend public money on provision of crematoria), whilst those at Woking, Manchester, Glasgow, Liverpool, Darlington, Golders Green, Birmingham, and Leeds* (Headingly) belong to private companies or societies. Two other crematoria are, or were, in contemplation, at Harrogate and Hornsey.

There is an important question which has to be faced at the outset when any scheme for providing facilities for cremation is under considera-

* The crematorium at Leeds belongs to the Headingly Burial Board.

tion, and that is the question of cost. In considering this we must make a distinction between (*a*) the initial cost of erecting a crematorium; (*b*) the working expenses of performing cremations.

(*a*) The cost of erecting a crematorium varies greatly with the style and size of the building desired. The furnace (the only really essential part) costs only a few hundred pounds, and if the furnace be simply placed in an incinerating chamber as an annexe to a cemetery chapel, as at Leicester and Sheffield, the extra cost involved is comparatively small. If, on the other hand, a separate building is provided, with a fine elevation and interior, and of ample proportions, including a columbarium, as at Bradford or Liverpool, the cost may be anything from £5,000 upwards.* At the present time, whilst the demand for cremation is so limited, the initial cost of a crematorium is a serious item. Should the demand, however, increase, as many believe it will do, this initial cost will be relatively lighter.

(*b*) The cost of performing cremations is independent of the capital outlay upon the buildings, and is a much more important factor when considering the respective merits of cremation and earth burial. For if cremation is to become popular with the masses, it is essential that its cost should be no deterrent.

The chief item in the cost of a cremation is, of course, the fuel consumed. This, however, is less than might be expected. Various kinds of fuel can be used according to the type of furnace adopted. In this country chiefly coal or coke have been employed hitherto, but it is possible that gas, from its greater convenience, etc., may in time to come supplant them. In America petroleum is used in a few places.

With a Simon type of furnace about one ton of coke is required for each cremation, costing, say, from 15 to 25s. With Toisoul, Fradet, and Co.'s gas furnaces about 6,000 cubic feet of gas is required, costing, say, at 2s. 6d. for 1,000 feet, 15s. When oil is used about 25 gallons are required.

* Cost of Crematoria.

Ilford, City of London	Total cost of building, including furnace and catafalque (about)	£7,000
Hull	Building (including furnace £422), furniture and fittings	2,700
Liverpool ...	Buildings only	6,100
Bradford... ...	... ... (about)	5,000
Manchester ...	(Including cost of land, £976)	6,277
Birmingham ...	... ... (about)	6,000
Golders Green	... ...	
Woking	... ...	5,000
Leicester ...	(Extra cost of crematorium only; the total cost of cemetery buildings was £13,830)	2,869

A considerable portion of the fuel consumed is required to heat the furnace prior to the introduction of the body. If more than one cremation took place consecutively, as would be the case if cremation became popular, a very considerable economy in fuel would be effected as well as a material saving in the wear and tear of the furnace. At present the latter is an item that must be liberally allowed for in estimating cost, but I am unable to give figures.

It is evident then that the amount of fuel required to reduce a body to ashes is not very great, and, occurring as it does only once, it ought scarcely to be regarded as an extravagance, even if there were no saving to set off against it. But the 5 lbs. of dry innocuous calcareous matter composing the residue or ashes remaining after a cremation do not require the 21 square feet of ground space requisite for earth burial. The saving here is considerable, and justifies the statement that the essential cost of cremation, where facilities exist, need be no greater than that of earth burial.

The Arrangement of a Crematorium.*

A complete crematorium comprises (*a*) the chapel, containing (*b*) the catafalque; (*c*) the incinerating chamber, containing (*d*) the furnace, or furnaces and chimney; (*e*) the columbarium; (*f*) mortuary; (*g*) vestry, waiting-room, offices, &c.

(*a*) *The Chapel,* in which the mourners assemble and in which the funeral service is held. It is not essential that a separate chapel be provided, and if the same chapel can be utilised as is used for earth burial, a great economy is effected. All that is necessary is that the catafalque, a table upon which the coffin is placed during the service before being consigned to the flames, should be so arranged as to be capable of being screened off when not in use. At the Leicester crematorium, the catafalque is placed in the chancel of one of two adjacent chapels in the Gilroes Cemetery, and when no cremation is taking place curtains are drawn across and both chapels can be used simultaneously for inhumation services.

The style of building selected will, of course, depend upon the views of those responsible, but it is important that the elevation should not be gloomy or forbidding. It ought not to be necessary to go to great expense

* For most of the technical details in this paper I am indebted to Mr. Albert C. Freeman's invaluable work, "Cremation in Great Britain and Abroad" (St. Bride's Press, Ltd.), I am also indebted to the same authority for the loan of the photographs and plans of various Crematoria exhibited at the meeting.

to avoid this. I would also suggest the desirability of there being nothing in the appearance of a crematorium suggestive of a heathen temple—an accusation sometimes brought against crematoria. Where any foundation for this exists it is scarcely calculated to allay religious prejudices.

(*b*) *The Catafalque.*—This being the last resting-place of the remains of the dead prior to disintegration, it should be worthy of its object, and it affords an opportunity for artistic effort. In most crematoria it is the principal feature of the crematorium chapel. At Leicester the catafalque is of carved oak, at Sheffield of bronze, and at Bradford and elsewhere of stone. The new catafalque at Woking is of marble and alabaster. After the coffin is once on the catafalque, it should not be necessary to subject it to any further handling. The catafalque is usually so placed with regard to the furnace that when the committal sentence is reached it can be silently carried forward by a simple mechanical contrivance, through draped or folding doors into the crematory chamber, and so on into the furnace. No glimpse or suggestion of the latter ought to be possible to the mourners in the chapel.

In the Glasgow crematorium the coffin is lowered from a central catafalque to the furnace chamber in the basement.

At the Devonport crematorium, Iowa, U.S.A., the body, after leaving the catafalque, is removed from the coffin and is passed into the furnace in a special steel cradle. This is no doubt an advantage so far as facilitating the process of cremation and reducing the time required is concerned, but there is obvious and serious objection from the sentimental point of view.

(*c*) *The Incinerating Chamber.*—The size of this will depend upon the number of furnaces to be installed. At the present stage of cremation probably a single furnace will meet all requirements for some time to come, but it is wise to provide space for a second furnace.

(*d*) *The Furnace.*—There are three principal types of furnace in use in this country, (1) The "Simon" type, designed by the late Mr. Henry Simon and made by Messrs. Simon, Limited, of Manchester. This burns coal or coke; (2) The Carbon Oxide Co.'s coke furnace, recently fixed at Golders Green and Woking Crematoria, and (3) The Toisoul-Fradet Gas Furnace, made by Messrs. Toisoul-Fradet & Co., of Paris, and fixed at Leeds and Bradford.

Several distinct advantages are claimed for the last, the principal being the cleanliness and convenience of gas as a fuel compared with coal or coke, simplicity and economy of working, and longer life. At Leeds, the average amount of gas consumed for the first 16 cremations was only

6,043 cubic feet, which at 2s. 3d. per 1,000 cubic feet, represents a cost for fuel of 13s. per cremation.

The following requirements were laid down as being necessary in a satisfactory crematory furnace by the International Congress on Cremation held at Dresden on June 30th, 1876:—(1) The cremation must be complete without coaly residue; (2) it must be performed only by a special apparatus for the purpose; (3) no gases or vapours which have any smell whatever must be allowed to escape into the air; (4) the ashes must be pure whitish and easily collected; (5) the incineration should take place in the shortest time possible; (6) the apparatus should be able to cremate rapidly several bodies in succession.

Whichever type of furnace is adopted, it should comply with the above conditions, and it is also necessary that it should be capable of withstanding the strain caused by the alternate expansion and contraction resulting from intermittent use. Some of the earlier furnaces erected failed in this respect. In any case, in estimating the cost of cremation, allowance must be made for wear and tear of the furnace.

As regards the chimney, a great height is not required. Freeman thinks 60 feet sufficient with any of the existing types of furnace, although the chimneys on some crematoria are rather higher.

It is usual to arrange for a pilot furnace at the foot of the chimney stack, but, although this is sometimes an advantage for starting the draught, it is probably not required for the purpose of a fume cremator, the temperature inside the furnace during a cremation (from 1,500° to 1,800° F.) being sufficient to prevent any unconsumed gases escaping.

The chimneys at the Leeds and Bradford Crematoria are concealed inside towers and are invisible. This is certainly a desideratum. A crematorium ought not to suggest even remotely an ordinary refuse destructor.

(*e*) *The Columbarium.*—It is usual to make some provision for storing the ashes of the dead, where this is desired. Where a separate building or chamber for this purpose (called a Columbarium, from the pigeon-hole appearance of the niches or receptacles,) is not provided, the walls of the chapel may be fitted up with niches as required. This course is being adopted at Leicester, Bradford, and elsewhere. At the Liverpool Crematorium the columbarium is in the basement under the chapel with direct access from it. The niches should be arranged to hold from 1 to 5 urns, so that family ashes can, if desired, be stored together. The urns in use for holding the ashes are usually of what is known as the "Box" shape, being 16in. by 8in. by 8in. high. The fronts of the niches should be closed with slabs of glass, marble, or other material.

Perhaps the finest columbarium in the world is that at San Francisco. It is a separate building from the crematorium, and provision is made for upwards of 4,000 niches.

Before leaving this part of our subject it will be well to consider the question of the best means of disposing of the ashes of persons who have been cremated. The fact that there is an indestructable residue after cremation is sometimes urged as an argument against the practice. "It is not total annihilation," the objectors say, "and after you have had your cremation, you have still to dispose of the ashes." This is true, but instead of being an objection, it is, in the eyes of many, an advantage. Sentiment (and it is impossible to dissociate the disposal of our dead from sentiment) calls for something tangible and material around which the memory of those departed may be focussed. Hence the fascination the graves of our dear ones have ever possessed. The ashes of the cremated dead satisfy this natural craving, but how much better, surely, to have to deal with the inoffensive residue purified by fire than with the noxious and putrefying corpse! The amount of ashes remaining after cremation averages 4 or 5 lbs., and consists of a whitish, gritty powder mixed with fragments of incinerated bone, and absolutely devoid of organic matter. Personally, I consider the best method of disposing of these is to bury them, and it is scarcely necessary to point out that the amount of ground required for this purpose is trifling as compared with that required for inhumation. But with many, the practice of storing the ashes in urns placed in niches finds favour, and hence the need for columbaria.

(*f*) *Mortuary.*—The necessity for a small mortuary in which bodies may remain prior to cremation is obvious, though, as it will only be occasionally required, no great expense need be incurred.

(*g*) *Vestry, Waiting-room, Offices, &c.*—A room for the officiating minister, and a waiting-room for friends and others remaining during the progress of cremation, are also desirable.

Management of Crematoria.

Every cremation authority is subject under the Cremation Act, 1902, to the regulations made by the Home Secretary. These are to the following effect:—

Every crematorium shall be maintained in good working order, be provided with a sufficient number of attendants, and be kept constantly in a cleanly and orderly condition. It shall be open to inspection at any reasonable time by anyone appointed for the purpose by the Home Secretary or Local Government Board. It shall be unlawful to cremate

the remains of anyone who is known to have left a written direction to the contrary, or remains which have not been identified.

Before any cremation can be allowed the following formalities must be complied with :—(1) The death must have been duly registered.

(2) Application must have been made on a prescribed form, and the particulars duly confirmed by statutory declaration (before a Justice of the Peace or Commissioner of Oaths) by an executor or near relative.

(3) Two medical certificates must be obtained, one from the medical man in attendance during the last illness, and the second (the confirmatory certificate) from a medical man who has personally investigated the cause of death. The medical man who gives this second certificate must be of at least five years' standing, and must hold some recognised public appointment, such as medical officer of health, police surgeon, or honorary physician or surgeon to a hospital.

Every cremation authority must appoint a Medical Referee, whose duty it is to examine all certificates and see that all the necessary formalities have been duly complied with, and no cremation may take place except upon his written authority. He has power to make whatever inquiries he thinks proper. He may, if he think it necessary, require a post-mortem to be made, and he may refuse to sanction a cremation without assigning any reason.

The precautions taken, and the formalities to be gone through before a cremation can take place, are such that the likelihood of cremation being resorted to as a means of concealing the evidence of foul play is so exceedingly remote that it constitutes no real argument against the practice of cremation. Indeed, the perpetrator of foul play would be well advised to avoid cremation if his object is to escape investigation and inquiry.

As compared with the lax precautions and trifling formalities which are at present required in the case of inhumation, the procedure necessary before a cremation can take place does undoubtedly seem somewhat formidable, and it is probable that this tends, in some cases, to prevent cremation being resorted to. In the public interest, however, we should agitate rather for an increase in the stringency of the precautions to be taken in the case of inhumation than for a relaxation of those required before cremation.

It is essential for the efficient carrying out of cremation that a responsible and intelligent official be appointed for the purpose; but as his services in respect of cremations will, at present, at any rate, be only occasionally required, it is desirable where possible that the post should be

combined with some other, *e.g.*, registrar of a cemetery. It is scarcely necessary to point out that it is most important that the whole process of cremation, from beginning to end, should be carried out in a manner at once reverent, orderly, and prompt. There should not be the slightest hitch, unnecessary noise, or anything calculated to jar in the slightest degree upon the feelings of the bereaved.

Dr. Louis C. Parkes (Chelsea) thought that cremation was not carried out on scientific principles, and that the body which contains 75 per cent. of water in its tissues should be dried or mummified by means of a hot air blast in a suitable chamber before being committed to the flames. The great cost of original construction and upkeep was due to the fierce temperatures necessary to destroy a body in the space of an hour or two, which caused expansion of the brickwork of furnace chamber and chimney, and subsequent contraction when the furnace cooled. These very high temperatures would not be necessary if the body was deprived of the greater part of its watery constituents before combustion. The drying process should, of course, be considered as a part of the cremation, the funeral service taking place on the arrival of the body at the crematorium.

Dr. Herbert Williams (City of London) referred to the cost of cremation, and pointed out that the cost of a cremation in the City of London crematorium at Ilford does not exceed £4, whilst the crematorium cost £7,000. The amount of coke necessary for a cremation would not be proportionally so much if a number of cremations took place each day, the prime cost being the amount of coke used in the first heating of the furnace, whilst the time occupied in the actual cremation was 65 to 70 minutes.

Cremations did not make such headway as could be desired chiefly owing to sentimental and religious objections, and perhaps also to the stringency of the regulations, which required the production of certificates. He referred to an instance where a young man who had died in Berlin had been brought to this country for cremation; the certificates were in order, but one was missing, the certificate of registration, and the Home Office decided that the cremation could not take place unless an inquest was held. Cremation did in only 70 minutes what it took several years to accomplish when the body was buried in the ground, and anyone who had had experience of the exhumation of bodies must appreciate the desirability of cremation.

Alderman Wilson (Newcastle) expressed his strong approval of Dr. Millard's paper, and also of the interesting remarks of Dr. Parkes and Dr. Williams, and hoped that so soon as sentiment and religious objection were overcome the practice would become universal.

Alderman Flowers (Newcastle-on-Tyne) expressed his appreciation of the manner and matter of the paper, but did not believe in cremation, and if a proposal were made to establish a public crematorium in Newcastle-upon-Tyne, the proposal would meet with his strongest opposition.

Mr. E. E. Lawson (Leeds) said that they had not a municipal crematorium in Leeds, as private enterprise in the way of a cemetery company had established one. He had visited cremations in various parts and there was nothing that anyone could object to. Unfortunately there was a prejudice amongst certain churches against this practice; well they, as sanatarians, whilst they respected their views, could only deplore their attitude. He knew the view was not a popular one. With regard to expense, if less money were spent in display, or rather if the same money were spent in cremation, it would be better from a sanitary point of view.

Dr. P. Boobbyer (Nottingham) said that modern-day sanatarians, as the exponents of almost the entire physical side and much of the moral side of civilization, must of necessity offer whole-hearted support to cremation. Destruction of the body by fire, he said, only hastened the process of inevitable decay, while depriving it of many of the gruesome details incidental to ordinary burial. He would recommend this view of the case to the consideration of sentimental objectors to cremation. Dr. Boobbyer then gave a description of the hideous nuisance frequently occasioned by the burial of bodies in leaden coffins. It seemed to him a matter for much regret that Christian churches and sects should so often oppose cremation. The church of Rome, he thought, was the most uncompromising opponent. Religious opposition was necessarily the most difficult opposition to meet. Medico-legal objections could be overcome by the imposition of adequate restrictive regulations, but the ex-cathedra opposition of religious bodies presented insuperable difficulties so far as the faithful of the opposing body was concerned. Let them not be discouraged, however. Truth and right would prevail in the end, and cremation represented truth and right in the disposal of the dead, as compared with all other available methods.

Dr. J. Scottiswoode Cameron (Leeds) said that he, like Dr. Williams, was medical referee to a crematorium, and confirmed his contention that some modification of the Home Office regulations would come in time. In one case a gentleman fishing in the Tweed was seized by apoplexy and landed in Scotland. No medical man saw him alive after his attack. There was no coroner's jury in Scotland. The Procurator Fiscal investigated the case and certified for burial: but this certificate, in the absence of certificates B & C, was useless in England. The difficulty was got over by a post mortem. In many cases the difficulties of the medical referee arose chiefly from the fact that medical men were apt to fill up form C, the confirming certificate, without reading it carefully, and therefore omitted certain very important answers, required to show that the writer of the

confirmatory certificate had given the cause of death his careful and impartial consideration,—that he had not adopted without enquiry the opinion of the medical man in attendance. In the great majority of cases there was no suspicion of foul play, but safety required that form C should be filled up quite impartially, and as the result of careful consideration of all the circumstances. Too often, however, the confirming medical man did not show in his certificate that he had made that inquiry, and interviewed, as required, the relations and nurses alone.

Mr. Luke M. Hill (George Town, British Guiana) referred to the practical interest he took in Dr. Millard's paper, as five years ago, on one of his periodical visits to this country, he had been charged by his corporation to obtain information with a view to preparing a report with plans and estimate for the erection of a crematorium in Demerara. On his return to the colony he put on paper the required information, taking as his type, with certain necessary modifications to suit local conditions, the crematorium at Golders Green with Simons' furnace for the use of coke as fuel. Unfortunately soon after, owing to the extinguishing of the local gas works in face of the advent of electric light, the fuel difficulty was intensified through the absence of coke as well as gas. With a freight of 40s. per ton the importation of coke was out of the question, and the local price of petroleum oil precluded its use as a fuel. He therefore wished to know if wood charcoal, which was prepared in the colony and largely used for domestic purposes, would be considered a suitable fuel for cremation.

Unfortunately, his estimate of cost, some £8,000, for a complete crematorium with the necessary adjuncts of mortuary chapel, columbarium, etc. (for he believed that cremation, if to be a success and to gain the confidence of the people, must be conducted decently and in order) was beyond the means at the disposal of his corporation, so the question had to be shelved for the present.

Mr. Hill, in conclusion, gave his personal experiences in the course of his duties, of the advantages of cremation over earth burial in the colony he came from.

Alderman O'Hanlon (Wallsend) said that where congestion existed the population was about 80 per cent. working class, and therefore those in higher places should set an example and not bury their dead in St. Paul's, Westminster Abbey, and other churches. The opposition of the churches was passive, and they had better let it remain at that and not provoke opposition by attacks. He hoped that it would never come to pass that the present system of burial would disappear, and that the new system advocated would supersede it. The whole policy seemed to savour of the American policy of hustle, that was, to get rid of our dead as soon as possible.

WOMEN HEALTH VISITORS.

By Miss C. COCHRANE.

(MEMBER.)

TO those who realise, with the late Dr. Richardson, that "National Health is National Wealth," and "National Wealth is National Health," one of the most promising movements of the present time is the increasing tendency to appoint women health visitors.

Wherever these appointments have been made the results have been satisfactory, and medical men have been unanimous in emphasising the good that has been done by well-trained women in immediate touch with poorer members of their own sex.

Although the work of the woman health visitor is more or less similar to that of the sanitary inspector, it is not the same, and I am now speaking only of the health visitor. Sometimes we find sanitary inspectors who are also health visitors, health visitors who assist in the supervision of midwives, and inspectors of midwives who devote a large amount of time to health visiting.

In addition to sanitary inspectors, health visitors are now employed in most cities and large towns: Birmingham has 17 and Manchester 16; but owing partly to the backwardness of public opinion, and partly to financial considerations, very few are as yet to be found in rural districts. Here unhappily all reforms are behindhand, and the interests and welfare of country people are continually overlooked and ignored.

If milk supplies are under consideration, it is the towns which are legislated for, and few persons seem to remember the hundreds of villages which have almost no milk at all, or only such as is obtained under most objectionable conditions.

If water supplies are discussed it is oftenest with the view of providing the towns, whilst villages are to be found in which there is no water fit to drink; where the scarcity is such as to cause actual privation; or where a quarter or even half a mile or further is not considered too great a distance from which to fetch the daily supply.

It has often been said that insanitary conditions which are common in the country would not be tolerated in the town, and those in authority case

their consciences by asserting that the pure air of the country atones for housing and sanitary evils.

But this is the case to a small extent only, and it cannot be proved that a cottage, the walls and floors of which are saturated with stagnant damp, is less unhealthy and liable to foster rheumatism and other complaints because it is in a village. Neither is it true that water which has passed through a churchyard, or is in close proximity to a dry-steined cesspit, is less injurious to drink because it happens to be in the country.

It will be no exaggeration to say that all those who have attempted to promote rural reform by direct measures have had to contend with very considerable opposition; and whilst it will still be necessary tactfully to pursue such measures wherever possible and advisable, it will also be wise to devote in the future increased attention to the organisation of side attacks, that by so doing the enemy may be more readily vanquished.

Amongst the side attacks on insanitary conditions in the homes of the agricultural population, two of those from which we may hope for much in the near future are the medical inspection of school children, and the appointment of more women health visitors. The one will probably lead to the other, for if the medical inspection of children is to be of the least national service and is to justify the large amount of money spent upon it, it will be absolutely necessary to follow up the inspections by visits to the homes of the children, in order to discover the causes of ill-health and to advise as to remedies. No persons could be found more suited to this work than well-trained women health visitors directly responsible to the medical inspectors of school children, and appointed by the County Councils.

In many instances, no doubt, the fault will be found to lie with ignorance as to feeding, clothing, and want of sleep and of fresh air: but there will also be numerous instances of children drinking polluted water, sleeping in overcrowded rooms or with very old people, breathing sewage-tainted air, and requiring milk which cannot be procured. It is in such cases as these that side attacks on insanitary housing conditions are likely to prove of very great value and importance. I would therefore strongly urge that public opinion be concentrated on the effort to obtain the appointment in rural districts of as many health visitors as will be required to complement the work of medical inspection of school children.

In Warwickshire the county medical officer, Dr. Bostock Hill, was so favourably impressed with the work done by the health visitors in Birmingham, and so strongly of opinion that such work was equally necessary in the rural and small urban districts, that he succeeded in obtaining for

these the appointment, at first of one, and in the end of four health visitors for the county.

In a paper read by Dr. Hill at a meeting of The Royal Sanitary Institute, he says:—

> "Speaking with some experience of the sanitary administration of every kind of district, I have no hesitation in stating that the need for health visiting is equally great in country and in town. While it is true that there is not the same overcrowding on space, and while many of the debilitating influences of town-life are absent in the country, yet the same, or a greater ignorance prevails of elementary physiology, and of the proper methods of feeding and rearing children; while also it is true, in many instances, that life has to be spent in dwellings more incompatible with healthy existence than the majority of those found in towns."

The Warwickshire health visitors are fully trained, their principal duties in the rural as in other districts, are to instruct mothers as to the feeding, washing, and clothing of their infants, and on the necessity for fresh air. As they are well versed in the sanitation of buildings, they take notice of any defects they observe, such as stopped drains, uncleanly closets, bad paving, dampness of houses, windows that will not open, stopped-up chimneys, and general uncleanliness of the place.

These defects are reported to the county medical officer, and at his expressed desire also to the district medical officer or sanitary inspector. "In this way," says Dr. Hill, "I have known in certain districts an immense amount of sanitary work done."

Rural districts are often large and have scattered populations, and sanitary inspectors are not able to make frequent visits everywhere, and Dr. Hill has found that, in the large majority of instances, the assistance rendered by the health visitors has been greatly appreciated by the sanitary authorities.

With the consent of the education authority, the health visitors give health talks in the village schools. They visit houses where children have been newly born; and when fully trained as midwives themselves they inspect midwives and their kit.

The Rural Housing and Sanitation Association (by the kind consent of Dr. Bostock Hill and the County Councils' Association) have obtained for circulation some reprints of a paper by Dr. Hill, recently published on this subject in the County Councils' Association's official circular. Copies of this leaflet can be obtained from the Secretary, Rural Housing and Sanitation Association, Parliament Mansions, Victoria Street, S.W.

Women wishing to qualify themselves for the important work of health

visitors will be glad to know that The Royal Sanitary Institute has now established a special examination for women health visitors and school nurses. Full particulars can be obtained from the Secretary, Mr. White Wallis.

One of the happiest signs of the present time is the increasing sense on the part of the public as to its responsibility for the moral and physical well-being of its children. To lovers of children, and to those who realize that "the child is father of the man," these signs are full of hope. Reformers cannot always promote reform in the way that appears to them the best; and their work will be far more valuable, and their influence more powerful for good if they are ready to seize opportunities as they offer, even if in doing so the schemes for which they have lived and worked are relegated for a time to a secondary place.

Every age has its failings, and also its special aspirations and gropings after higher things, and it is the part of the true reformer to know how to take advantage of these for the greatest good of mankind. For just as the rising tide, if uncontrolled, will spend its strength in vain efforts to destroy barriers, these same barriers may be circumvented if the new and cleansing forces are wisely directed into the ways of least resistance.

Alderman Flowers (Newcastle-upon-Tyne) expressed his surprise that there was any difficulty in urban districts of obtaining milk for children, as stated by Miss Cochrane. He was of opinion that the health visitors should be fully qualified as health visitors, also as midwives under the Notification of Births Act.

Miss Eva H. Jones (Bradford) said, as a woman sanitary inspector, she would like to endorse the remarks of Miss Cochrane on the importance of employing only fully qualified women in this work. Innumerable difficulties must arise with untrained workers. Were Councils more careful to appoint only well-trained and tactful women, the difficulties complained of would soon disappear. In public health work it was essential to have the welfare of the people at heart, and those who worked for the love of their fellow-men rarely met with any opposition.

Alderman Hindmarsh, Dr. Spottiswoode Cameron, and Councillor Lawson also took part in the discussion.

A SUMMARY OF INDUSTRIAL LEGISLATION FROM THE MEDIÆVAL PERIOD.

By T. OWEN EDWARDS.

THE efficiency of factory legislation in our country has not been obtained in a short time. Events in our industrial history have resulted in enactments made to meet the particular need of the event. In considering the history of England in the fourteenth century, two things stand out as having a powerful effect on the industrial conditions of our country, the great wars with France, and the Plague, which acted on the industrial conditions in the same way, that is, by producing a dearth of labourers. The wars with France lasted so many years that the proportion of able-bodied men who were killed was comparatively great; and in addition, the continued absence of labourers on the Continent brought down the numbers of possible labourers to a minimum. The service of the King made a more powerful appeal to the populace than the peaceful industrial and agricultural callings. When the tide of human beings had flowed back to our island, and there was a prospect of the conditions of labour becoming normal, the "Black Death" appeared and decimated the population. The dread disease was potent not only against the weak and ailing, but against the strong and healthy: indeed, the latter appear to have suffered more than the former. The demand for labour was so much in excess of the supply that it enabled those men who could work to demand a high rate of wages. As a result of this the price of food stuff became excessive, and there is no doubt that the ravages of the plague in the later months were increased by the semi-starved state of the poorer classes. Affairs became so bad that in 1349 an Act was passed prohibiting labourers and certain craftsmen from taking more for their labour than they were wont to be paid during the previous six years. But it was found that although wages were reduced the prices of food remained high, with the result that the ordinary labourer could not obtain sufficient nourishment with the wages he earned, and in order to remedy this there

was passed in the same year an Act which prohibited bakers, butchers, and brewers from selling food except at a reasonable price.

It is interesting to note the methods then in vogue of obtaining obedience to the law, for the Bishops were requested to have these statutes published in the churches and to direct the clergy to exhort and admonish their parishioners to observe the statutes. A more forcible method was used in 1352, when an Act was passed fixing the wages of labourers and certain artificers at a definite standard, penalties being imposed for giving or receiving more than this. The enactment was made only for the benefit of the employer, and the attempt at fixing wages with this end only in view naturally resulted in disaster.

In the later years of Edward III. there was a marked growth in the manufactures of the country, and English wool, which had previously been exported to Flanders, was woven at home. Coincident with this increase, enactments were made with the object of fixing the rate of wages and conditions of labour. In 1360 the various enactments of the previous 20 years were summarised and confirmed, and attention was paid to the combination of labourers which had resulted from these enactments. In 1376 a decree was issued which forbade these combinations; and a greater consideration of the labourers was shown in this decree which included a clause forbidding the unfair exactions of employers.

In the reign of Henry IV. the question of migration of the population into the towns, with the resulting dearth of labour in the country, first forced itself on the notice of the authorities, and in 1406 an attempt at checking the migration was made by legislation. After over 500 years the same social problem presents itself to-day, and its solution is taxing the ability of our greatest statesmen; the exodus and unemployment are coincident, and the solution of one will mean the solution of the other.

In the reign of Henry V. the conditions existing in 1348 returned. The war with France resulted in a great dearth of labour, and in 1414 the old Statute of Labourers fixing the standard of wages was re-enacted. The legislation of the years following 1414 was of but little interest, but in 1450 an Act was passed regulating the hours of labour, and in 1496 the time allowed for meals was also fixed: half an hour was given for breakfast and one and a half hours for dinner and the sleep which was usually taken in the summer-time after the meal; in the winter one hour was allowed for dinner, an arrangement which gives an interesting indication of the habits of labourers of those days.

At this time there was considerable alarm at the depopulation of the

Isle of Wight owing to the conversion of tillage into pasture land, which resulted in only two or three herdsmen being employed on land which previously gave employment to two hundred labourers for its tillage. The alarm was created by the lack of men for the purpose of defence against attack from France, and it resulted in an enactment being passed in 1488 which prohibited any man from taking a farm of more than ten marks on the island, and which further enacted that tillage land should not be converted into pasture land.

Until the year 1495 no notice of shipwrights had been taken in any of the enactments, but shipbuilding had gone on increasing, becoming a recognised branch of industrial occupation, and for the first time the wages of shipwrights were fixed by statute. This was coincident with the foundation of the British Navy, the first ship possessed by the Crown being built this year and costing £14,000.

In 1530 the first Aliens Act was passed. A roaming class of people then known as Egyptians had for some time flocked into the country, moving from shire to shire, using no craft except the subtle craft of deceiving people by palmistry. It was therefore enacted that no more of their class should enter the realm, and further, that within sixteen days all should be sent out of the land, but still we have the Romany with us in these modern days.

In the reign of Edward VI. a great deal of attention appears to have been given to wastrels and wanton persons: fines were inflicted for skulking, and if a man was convicted for loitering or not applying himself to labour he was liable to be branded and sold as a slave for the period of two years. This Act, which marks the reintroduction of slavery into England, was repealed a few years after its introduction.

The reign of Mary was marked by a curious enactment which regulated the number of looms which a weaver might possess, but there was very little further industrial legislation until the reign of Elizabeth, when the interesting Statute of Apprentices came into force in 1564. This was a direct attempt to produce labourers skilled in the various arts and crafts, and, although some of the clauses showed lack of foresight, there is no doubt that the statute did much to help the progress of industry during the reign. By the statute no one was allowed to exercise an art or craft unless he had been apprenticed for seven years, and there was also a regulation that there should be one journeyman to every three apprentices. This Act was repealed in 1817, as it restricted the supply of labour, which enabled the men to combine against the employers.

In the century following 1564, legislation was directed mainly towards the regulation of wages, and in the early years of the eighteenth century it was found necessary to prohibit the combination of workmen in the woollen trades. A period of more active industrial legislation was started in 1770, when the first spinning mill was erected in the country. Its establishment sounded the death knell of nearly all home work spinning. One worker could attend to a hundred power spindles, and each spindle turned out twice as much work as the hand spinning wheel, so that the magnitude of the effect is not to be wondered at. The introduction of power driven looms soon afterwards had a much smaller effect. It is true that the power loom was four times as rapid as the hand loom, but the hand woven article was superior to the power woven one. This superiority still exists, with the result that the hand weaver works to-day not only in the factories, but also in his own cottage.

In the years following 1770 the gradually increasing use of water power in the chief industries of the country resulted in the increasing suppression of housework, with evil results. Some of those evils were those arising from the sites on which the new power mills were built. The dependence of their machinery on water power necessitated their close proximity to streams, and frequently they were erected on damp soil or water-logged morasses. The ignorance of people concerning matters of sanitation resulted in these buildings being most insanitary and unsuitable workplaces. With the development of these water-power mills began also another evil, which grew into a horror that marks one of the greatest blots in our industrial life, the system of child apprentice labour. The heartlessness and brutality of the system, together with the insanitary state of the mills already mentioned, resulted in the passing of the first Factory Act in 1802, known as the "Health and Morals Act." For a few years the evils of child apprenticeship were lessened, but the introduction of steam power in the early years of the nineteenth century enabled manufacturers to erect mills in the populous districts and thus to evade the provisions of the Act in many ways. Then began the horrible chapter of our history. At first parents refused to allow their children to work in the mills, but the guardians of the poor had no such scruples concerning the poor law children, and the resulting decrease in wages compelled the working people to take their own children to the mills and make wage-earners of them.

Describing these conditions of child labour, Sir John Gorst says, "The guardians of the poor sold parish children from five years old and upwards to manufacturers; these helpless children were conveyed to the

manufacturing districts on canal boats in a manner which recalls the horrors of the slave trade; they worked sixteen hours at a stretch; they were fed with the pigs; and the mortality was awful."

These evils resulted in a Parliamentary Commission on the subject, and the forcible evidence given was soon afterwards followed by legislation which aimed at reducing the evils. Act followed Act, and legislation has continued until the present day, when the conditions of factory life are more consistent with the standard of living which our present state of civilisation and our sense of humanity demand.

It will be seen that the beginning of the nineteenth century was marked by a change in the aims of industrial legislation. Up to that time, nearly every enactment arose from the desire to protect the employer, but afterwards legislation was brought about with a fuller consideration of the needs of the employed. An indication of this may be seen in the sentence of twelve months' hard labour given to an employer for employing a girl for long hours beyond her strength and neglecting to feed her properly, so that she became emaciated and her health impaired.

The Factory Act of 1833 is interesting on account of its making a distinction for the first time between a "child" and "young person," the hours of the former being restricted to nine and of the latter to twelve hours per day. It was by this Act also that the first factory inspectors were appointed, but as there were only four appointed for the whole country, the benefits resulting were on a very small scale.

The attempts of some of the advanced legislators to protect the work of women culminated in 1844 in an Act which regulated the hours of women, and made them the same as those of young persons. In this Act the guarding of certain kinds of machinery was enforced. Until 1860, legislation had applied to textile factories only, but in that year and the year following other industries allied to the textile trade were included; and in 1864 there were included six other trades which were not allied to textile. Amongst them was fustian cutting, and as this was largely a home industry, this is the first Act which refers to home-workers.

In 1863 the Bakehouse Regulation Act was passed. This Act prohibited the employment in bakehouses of persons under eighteen years between nine p.m. and five a.m. It also referred to the sanitation and ventilation of bakehouses, and contained additional regulations with respect to bakehouses in towns or cities of more than 5,000 persons. These regulations with some additions have continued in force to this day. The provisions of the Act divide themselves into two classes, sanitation and hours of employment. The duties of enforcement being in the hands

of the local authorities who were the same bodies as those entrusted with carrying the Nuisance Acts into operation.

Following Commissions, notably the Children's Employment Commission in 1867, public opinion brought about the extension of the Factory Acts to all works where mechanical power was used in aid of manufacture. In the same year the Workshops Regulation Act was passed, by means of which practically all labour exercised by way of trade or gain was brought under inspection and the experiment was tried of making the local authorities responsible. The experiment proved a failure, and after four years the responsibility of enforcing the Act was transferred to the Home Office, and this resulted in the places under the inspection of the Factory Department being quadrupled. The Workshop Regulation Act did not contain any sanitary provisions, the sanitary conditions of workshops being regulated by the Sanitary Act of 1866, under section 19, which included under the definition of a nuisance any factory, workshop, or workplace not kept in a cleanly state, not sufficiently ventilated, or which was overcrowded. Therefore it will be seen that though the enforcement of the Workshop Regulation Act of 1867 was transferred to the factory inspectors, they had no direct authority to enforce the sanitary provisions in workshops. Their power in that direction was confined to advice, whilst bakehouses were outside their jurisdiction.

Upon this subject the Report of the Royal Commission appointed in 1875, in pages 18 and 19, stated "In the Bakehouse Act there are no educational provisions, and indeed, children are in no way mentioned in the Act." Mr. Cooke Taylor (until recently one of H.M. Superintending Inspectors of Factories) writes, "That children refused by certifying surgeons for work in the lighter industries for 10 or 10½ hours a day, were sent down into the bakehouse apparently for 16 hours at a stretch! This arrangement, I am informed, is facetiously described as putting them in the hot-house to mature."

The Public Health Act, 1872, for the first time constituted urban and rural sanitary authorities throughout the country. Then in 1875 the Act of 1872 and the majority of the sanitary Acts were consolidated in the Public Health Act of that year, but the Bakehouse Act of 1863 was not included, and therefore the duty of enforcing it remained unchanged.

In 1878 all previous Factory and Workshop Acts were consolidated, and the definition of factory and workshop altered. One of the most important changes was the bringing of workshops where young persons or children were employed under the same regulations as non-textile

factories as regards hours, sanitation, and conditions of employment: whilst workshops in which women only were employed and domestic workshops were subjected to modified restrictions as to hours of employment and were exempt from the sanitary provisions of the Act.

In 1891 another Factory Act was passed having for its object the bringing of all factories and workshops to the same level of sanitation. Under this Act all workshops, except bakehouses, which throughout have been specially legislated for, were exempt from the sanitary provisions of the Act. Therefore the sanitary condition of workshops was again transferred to the local authorities, to be dealt with under the Public Health Acts, and with a reservation of certain powers for the factory inspectors in default of the local authorities. The transfer of duties was not at first a success, the responsibility of the local authorities not having been fully recognised by them. But the Act of 1895 made it compulsory for the local authorities to report to the factory inspector the proceedings taken with regard to complaints received from him. This led to action and an advance in enforcing the sanitary provisions in workshops, and this improvement, with some exceptions, has continued up to the present.

The existing Factory Acts apply to factories, workshops, domestic workshops, laundries, docks, buildings in the course of construction, and warehouses. With the exclusions of factories, the provisions of section 91 of the Public Health Act have an equally wide application. The functions of the Factory Department and the Local Authorities have not been changed by recent legislation; the duties of the Local Authorities having been set out by the memoranda issued by the Home Office.

There is considerable administrative machinery in existence for the control and improvement of the conditions of life in our factories and workshops, and by the full co-operation of the two services this is steadily being effected.

CONGRESS AT CARDIFF.

CONFERENCE OF MEDICAL OFFICERS OF HEALTH.

ADDRESS

By EDWARD WALFORD, M.D., D.P.H.,
Medical Officer of Health, Cardiff,
(FELLOW),
PRESIDENT OF THE CONFERENCE.

"SANITARY PROGRESS IN CARDIFF."

THE appointment of medical officer of health for Cardiff dates from the year 1847. It was, I believe, one of the earliest, if not quite the earliest appointment of the kind made in the United Kingdom. Judging from the condition of the town as described by that officer, the appointment was not made at all too soon. Fortunately in that year the local authority was able to secure in my predecessor, Dr. Paine, an officer of unbounded energy and perseverance, and to retain his valuable services until the year 1888, when I was appointed. To him and to the local authority, who acted upon his advice, we are largely indebted for our present reputation in health matters. The rapid increase in the population in the urban district of Cardiff is shown in the census returns since 1801, as follows:—

Census Population.		Estimated Population.	
Year.	Population.	Year.	Population.
1801	1,870	1902	168,909
1811	2,577	1903	172,598
1821	3,521	1904	176,313
1831	6,187	1905	180,054
1841	10,077	1906	183,823
1851	18,351	1907	187,620
1861	32,054	1908	191,446
1871	39,536		
1881	85,371		
1891	128,915		
1901	164,333		

The corporation of the city of Cardiff is responsible for the sanitary administration of the town and port. Nominally there are two separate bodies, the Urban Sanitary Authority having jurisdiction over the whole of the city and the Port Sanitary Authority over a part of the Customs

port of Cardiff, extending from the mouth of the River Rumney to the common boundary of the parishes of Sully and Lavernock; the district extending three miles seaward from low-water mark, and including all docks, rivers, canals, etc., within that limit. In both cases, however, the City Council acts as the Sanitary Authority, and delegates most of its executive power to the Health and Port Sanitary Committee. Both authorities have now an efficient and well qualified staff of inspectors. Those acting for the town comprise an inspector of nuisances, who is chief inspector, five assistant district inspectors, six special inspectors in connection with infectious diseases, the inspection of lodging-houses, factories, and workshops, meat and other foods. There are also three disinfectors, three clerks, and two women inspectors or health visitors.

The staff in the port sanitary district comprises a chief inspector, five assistant inspectors, and one clerk.

In 1888 the staff of the medical officer of health consisted of one inspector of nuisances, who acted both for the town and the port, and two assistant inspectors.

The commercial prosperity of the town and port dates from the opening of the first or West Dock, by the Marquess of Bute in 1839. The construction of the complete system of docks necessarily brought into the town an enormous number of labourers and artizans, and housing difficulties arose. After a time, however, enterprising builders did their best to keep pace with the times, and we find from the returns that in 1871 there were 8,135, and in 1891 20,476 inhabited houses.

During this period the population increased by 44 per cent. and the inhabited houses by 65 per cent.

The number of inhabited houses in 1907 is given as 30,671.

During the period 1841-51 the housing problem seems to have reached an acute stage in certain parts of the town. In 1846-47 large numbers of labourers came over from Ireland, and the medical officer of health reports that house accommodation was utterly inadequate to meet the requirements; overcrowding necessarily resulted, sleeping apartments were never empty day or night, as beds vacated by those proceeding to work were immediately occupied by relays returning. A glance at the vital statistics for the years 1847, 1848 and 1849 shows that in each of those years the number of deaths exceeded the number of births, the deaths numbering 484, 579, and 864, and the births 331, 428, and 466, respectively. A death-rate of about 48 and a birth-rate of 25 per 1,000 prevailed during that period. The inspectors of the Board of Health reported that the town was in a deplorable condition at that time. Beyond a partial means of carrying off surface-water and house-slops no provision for drainage

existed. The supply of water was inadequate and impure, the dwellings of the poor were of the worst description and much overcrowded, epidemics of various kinds prevailed. Shortly after this report, namely about 1850, the Local Authority commenced attempts at sanitary reform.

The gradual reduction in the death-rate since the year 1852 is shown in the following Table, which gives the annual average death-rate per 1,000 in decennial periods and in years since 1901.

	Death-rate per 1,000. All causes.	Zymotic diseases.		Death-rate per 1,000. All causes.	Zymotic diseases.
1852-61	29·2	6·3	1902 ...	16·9	2·6
1862-71	24·2	4·6	1903 ...	14·4	1·3
1872-81	20·0	3·2	1904 ...	15·2	1·8
1882-91	21·5	3·3	1905 ...	13·5	1·1
1892-1901	17·9	2·3	1906 ...	14·2	1·3
			1907 ...	15·0	1·9

The death-rates per 1,000 from the several infectious diseases during the decennial period 1865-74, as compared with those of 1897-1906, is given below.

	1865-74.	1897-1906.
Small-pox	·34	·01
Measles	·49	·40
Scarlet Fever	·72	·10
Diphtheria	·10	·39
Fever, including Typhus and Enteric Fever	·92	·09
Diarrhœa	·84	·66

Small pox, scarlet fever, and enteric fever during this period show a marked decline in their rate of mortality; and it is worthy of note that Asiatic cholera and typhus fever, which formerly prevailed from time to time in an epidemic form, have disappeared from the mortality returns.

The rate of infant mortality has declined from 165 deaths under one year per 1,000 births in the decennial period 1881–1890, to 145 in 1897–1906, and to 131 in 1907; the lowest recorded rate being 118 in 1905. It will be seen that diphtheria is the only disease which shows an increased rate of mortality during the more recent period. It was during the early part of this period that a severe epidemic wave of diphtheria swept over South Wales, particularly the colliery districts at the back of Cardiff. In 1897 the death-rate from this disease rose to ·6, and 1898 reached the high figure of ·83 per 1,000. Since 1902, however, a steady decline has taken place in the diphtheria death-rate, as follows:—

Year.	Diphtheria Death-rate.	Year.	Diphtheria Death-rate.
1902 ...	·52 per 1,000	1905 ...	·12 per 1,000
1903 ...	·20 „	1906 ...	·07 „
1904 ...	·17 „	1907 ...	·12 „

The rates of mortality from small-pox in both the decennial periods are low as compared with those which prevailed in days when vaccination was not enforced and when hospital isolation was unknown. In the ten years 1847–56, the death-rate from small-pox was 1·04 per 1,000; in 1857–66 it was ·87; in 1867–76, ·14: in 1877–86, ·2: and in 1897–1906 it was ·01 per 1,000. Three administrative reforms have been the means of placing small-pox very completely under control, vaccination, compulsory notification, and hospital isolation, with which must be included the prompt detection of the disease when brought into the port by shipping.

With respect to the decline in the mortality from scarlet fever, I believe this to be largely due to improved administrative methods, compulsory notification, domiciliary visits by the staff of the Health Department, disinfection, co-operation of school teachers, and certainly to hospital isolation. Notwithstanding all that has been said to the contrary, I still believe firmly in the advantages of this form of preventive medicine. I have no desire to place too much value upon statistics in this matter. They do not, I think, present very convincing arguments on either side in this controversy.

It is apparently impossible to compare one town with another, or one group of towns with another group by this method. Dealing with Cardiff alone for different periods of isolation and no isolation, the figures are as follows: I give them for what they are worth. It so happens that in Cardiff, two distinct and somewhat severe epidemics of scarlet fever have occurred; one in 1892, when there was practically no provision for the isolation of such cases in hospital, and the other in 1902, when this form of isolation was freely resorted to. In the epidemic of 1892, 13 per cent. of the cases of scarlet fever were removed to hospital, the attack-rate was 13 per 1,000 of the population, and the death-rate ·65 per 1,000. In 1902, 48 per cent. of the cases were removed: the attack-rate was 8 per 1,000, and the death-rate ·21.

In 1884 there was also a severe epidemic when there was no isolation hospital, the attack-rate was 28 per 1,000, and the death-rate 1·36 per 1,000. As at this time the compulsory notification of cases was not carried out, it is only possible to judge of the number of cases, and to estimate the attack-rate upon the basis of the deaths. Assuming that the proportion of deaths to cases was the same as in the epidemic of 1892, *i.e.*, 4·7 per cent. (the highest on record), there would have been 2,723 cases in the town with a population of 93,468, giving an attack-rate of 28 per 1,000. If we compare periods of five years, the result is also favourable to hospital isolation.

Years.	Isolated in hospital.	Attack-rate.	Death-rate.
1890–94	16 per cent.	6·1 per 1,000	·28 per 1,000
1895–99	50·3 „	3·5 „	·08 „

But quite beyond this statistical aspect of the case, I am inclined to think that the value to certain classes of the community of hospital isolation has not been sufficiently emphasized. The educational value is enormous; without this form of isolation the interference with education by preventing the school attendance of those who have been in contact with infection is a most serious matter. Again, the interference with certain trades and occupations, milk vendors, laundries, tailors, dressmakers, etc., is reduced to a minimum when cases of scarlet fever are promptly removed to hospital.

Perhaps no disease has made such a gratifying response to sanitary reform as enteric fever. The mortality in Cardiff has been reduced from ·92 per 1,000 in 1865–74, to ·09 in 1897–1906. This rate has not been exceeded since 1900, and has on two occasions fallen as low as ·04 per 1,000. Since 1890 the cases of enteric fever notified have fallen from 1·3 to ·2 per 1,000 of the population, and during the past few years the great majority of these cases were imported into the district by foreign shipping.

Cardiff has shared in the decline in the rate of phthisis mortality which has obtained throughout the country generally.

The following table shows the death-rate from this disease since the year 1880:—

Year.	Death-rate per 1,000.	Year.	Death-rate per 1,000.	Year.	Death-rate per 1,000.
1880	3·21	1894	1·62	1900	1·25
1881	2·96	1895	1·67	1901	1·05
1882	2·86	1896	1·38	1902	1·29
1883	2·67	1897	1·99	1903	1·19
1884	2·97	1898	1·32	1904	1·36
1885	3·58	1899	1·32	1905	1·28
1886	2·78	1890	3·18	1906	1·2
1887	2·72	1891	2·78	1907	1·17
1888	2·8	1892	1·82		
1889	2·79	1893	1·68		

The voluntary notification of phthisis was adopted in 1901, and a fee of 2s. 6d. is paid for each notification. This procedure, notwithstanding its obvious defects, has been of some service. On an average about 140 cases are notified annually. The houses of these consumptives are visited and re-visited by the health visitors, and instruction in the necessary precautions is given. By-laws have been passed prohibiting spitting in public places or vehicles, tramcars, etc., and although no convictions have been obtained for infringing these by-laws, an improvement has taken place in this matter, especially in tramcars, which formerly used to be little better than huge spittoons. A considerable amount of disinfection is carried out by the sanitary authority in connection with

premises and articles subject to tubercular infection; and at the request or with the consent of the medical attendant, the patient's sputum is examined at our bacteriological laboratory free of charge.

The isolation of infectious cases in hospital was not seriously commenced until the year 1892, when a temporary hospital was somewhat hastily erected in consequence of an epidemic of scarlet fever, on a site previously acquired, and upon which now stands the permanent sanatorium. Isolation was hardly the term to apply to the method adopted at the old wooden shed connected to the Seaman's Hospital, formerly used for infectious cases, as any passer by could converse or even shake hands with his friends inside, if he did not happen to meet them in the uninclosed airing ground immediately surrounding the building. In 1896 the permanent hospital was opened, which gave accommodation for 50 patients in two pavilions, and an isolation block; the temporary structure being retained for smallpox.

In 1900 three new pavilions were constructed, bringing the accommotion up to 116 beds for the ordinary infectious disease, and 50 beds for smallpox cases; the smallpox hospital being completely separated from the other buildings. In addition to these hospitals the Port Sanitary Authority has a special hospital on the Flat Holm Island for the reception of cases of cholera, yellow fever or plague, containing 16 beds, with laundry and post-mortem room attached. A crematorium has been constructed on the island for the disposal of those dying from these diseases in the hospital or on board ship.

From what has already been mentioned, it will be gathered that the sanitary arrangements in Cardiff about 50 or 60 years ago were of such a nature as to encourage the spread and development of zymotic and other diseases. The town was in this respect quite unprepared for the large addition to its population consequent upon its increasing commercial prosperity. Overcrowding to an inconceivable extent occurred; and in parts of the town where overcrowding was most undesirable, four-roomed houses were occupied by 50 or 60 people. Crowds of labourers arrived, particularly from Ireland, where in 1846–8 typhus fever and famine prevailed to an alarming extent. This disease was thus introduced into the crowded localities of Stanley Street, Mary Ann Street, Love Lane, and in several old and dilapidated courts. In 1846–7 180 deaths from typhus fever occurred amongst a population of about 14,000. Very shortly after this (1849) cholera was introduced from abroad, and attacked the same localities, causing 350 deaths. At this time the houses occupied by these people were without proper ventilation or air space, front or back; they were damp, dark, and dirty, defective in drainage and in

closet accommodation, and without proper water supply. However, soon after this improvements were taken in hand. Up to 1850 the water supply of the town was derived entirely from wells sunk in the porous gravel extending under the greater part of the town, and highly polluted from defective drains, privies and cesspools. In that year a company was formed, which obtained powers to construct works and supply water to the town and neighbourhood, first from Ely, two miles west of Cardiff, and afterwards from Lisvane and Llanishen, four miles north of the town.

In 1879 the corporation acquired the property of the company, and in 1884 obtained parliamentary powers for impounding and utilizing the water from the gathering grounds and watersheds on the Brecon Beacons, and in the Taff Fawr Valley beyond the northern outcrop of the South Wales coalfield, and for constructing storage and balancing reservoirs, filter beds and other necessary works: the storage capacity of the three reservoirs being about 1,220 million gallons. The water is conveyed by conduits, pipes, etc., to the reservoirs at Lisvane and Llanishen, a distance of 32 miles. When the third reservoir is complete there will be at the disposal of the district between 9 and 10 million gallons of pure and soft water per day. The total hardness of this water may be placed at 4 degrees as compared with the 18 degrees of the Lisvane water formerly in use. There can be no question that to the new water supply is due very much of the improvement of the public health of the district.

About 1855 sewage works were commenced. Before this the only drains existing were used solely for conveying surface water and household slops to the outfalls in the Bristol Channel and River Taff. They were badly constructed and contained large deposits of filth, giving off offensive effluvia from the openings in the streets. The excreta passed into cesspools which polluted the gravel from which the water supply was derived. The roads were not macadamized and in wet weather were impassable. The sewage works and the construction of drains were carried out with such energy that practically no cesspool has existed for many years. Outfall sewers discharge the contents of the drains and sewers of the district by gravitation into the Bristol Channel.

No large insanitary areas have been dealt with under Part I. of the Housing of the Working Classes Act, 1890. In fact there are none which could be conveniently brought under the operation of this part of the Act.

A considerable number of individual houses, chiefly in small courts, have been closed as unfit for habitation, under Part II. of the Act. Altogether, closing orders have been obtained with respect to 62 such

houses. Some of the old courts have, however, been demolished voluntarily by owners of property for the purpose of reconstruction and general improvements, and to make room for extensions of business premises.

The absence of private slaughter-houses within the city has enabled the local authority to supervise the meat supply in a much more satisfactory way than would otherwise be the case. A qualified veterinary surgeon acts as chief meat inspector, with six inspectors under him. The system of inspection results in the destruction of about 50,000 lbs. of unsound meat annually.

A well-equipped public health laboratory has been established in connection with the medical officer of health's department, in which bacteriological and chemical work connected with public health administration is carried out. This laboratory has been of the utmost value, especially in the examination of food, water, sewage effluents, air and pathological specimens. It is also used for teaching purposes, and forms an important part of the equipment of the Public Health Department of the Medical Faculty of the University College of South Wales and Monmouthshire.

Up to the year 1892 the disinfection of infected articles, when carried out at all, was effected by means of a hot air stove of obsolete pattern and of imperfect construction. This method of disinfection was abandoned on the completion of the Isolation Hospital, when a Washington Lyon's disinfecting apparatus formed part of the hospital equipment. This, however, soon proved inadequate for the use of the town and was retained entirely for hospital purposes. In 1902 a temporary disinfecting station was established on land belonging to the corporation. This answers its purpose fairly well, but will, I hope, soon be replaced by a more suitable permanent building with all the modern requirements.

The most recent development in connection with the health department in this city is in relation to educational matters. The local authority, acting upon the advice of the Board of Education, has co-ordinated the work of medical inspection of school children with that of the general public health work, of which it obviously forms a most important branch. The medical officer of health acts as medical officer to the education authority, and has the services of two medical assistants, one male and one female. Two lady health visitors devote some of their time to work connected with this inspection. It is, of course, too early to base any sort of conclusion upon the results of this work, but already there are indications of benefit to the rising generation.

REMARKS ON THE SANITARY SERVICE OF THE TERRITORIAL FORCE.

By Lieut.-Col. J. ARNALLT JONES, V.D., M.D., D.P.H., R.A.M.C.T.,

Sanitary Officer, Welsh Division, Territorial Force.

IN the Volunteer force which passed away so recently very little was done in the way of sanitary work, except perhaps here and there where a medical officer who had a good knowledge of public health was permitted to carry out his health-principles in the field with the approval of the combatant officers in command. The bulk of the work was done under the direction of the Quarter-masters of regiments, with little or no interference from the regimental surgeon.

Then later Volunteer Infantry Brigades were formed, about forty-seven in number, and one of the medical officers attached to a battalion of the Brigade was detailed by the senior medical officer to act as Brigade Sanitary Officer. Rarely was this officer a sanitary expert, and his office might be onerous or light as he himself chose to make it.

Under the new scheme of home defence it would seem that the sanitary branch of the medical service is to play a prominent and useful part.

To the staff of each division a sanitary medical officer will be appointed, one holding a diploma in public health or an important civil post, as M.O.H., and certainly a man of experience.

Each Infantry battalion in the field, consisting of 1,024 of all ranks, will have for its sanitary staff its medical officer and five men of the R.A.M.C. attached, and eight regimental men.

Each Cavalry regiment, consisting of 541 of all ranks, will have one medical officer and three rank and file of the R.A.M.C. attached; and each Mounted Infantry battalion, consisting of 638 of all ranks, and Horse Artillery brigade, of 688 of all ranks, will have a similar number; and each Field Artillery brigade, with 974 of all ranks, will have a medical officer and four rank and file of the R.A.M.C. attached. Again the various

Royal Engineer units of different strengths, Army Service Corps, Supply columns, etc., will have medical officers and varying numbers of rank and file of the R.A.M.C. attached to them.

Then again, there will be sanitary sections, consisting of one officer and 25 other ranks of the R.A.M.C., and sanitary squads of six men of the R.A.M.C. and at the base of operations a sanitary company; whilst laboratories will be provided where required, *e.g.*, at the base and on the lines of communication; and on mobilisation a Sanitary Inspection Committee will be formed, with a roving commission for service in the field, consisting of a combatant officer as president, and a field officer of the R.E. and a field officer of the R.A.M.C. as members of this committee, which, acting under the orders of the Commander-in-Chief, will co-ordinate the sanitary organisations, civil and military, of the area of country occupied, draw out schemes, visit and inspect stations, see to the supply, and the maintenance of reserve of sanitary supplies and material, and assist and advise the combatant and medical services in their endeavours to maintain the Army in health.

So we see the scheme of disease prevention may be considered under two heads: The sanitation of the unit; The sanitation of the mass.

For carrying out the sanitation of the unit, let it be a battalion of infantry, a regiment of cavalry, a battery of artillery, or any like body, we have an officer, N.C.O., and three or four men of the R.A.M.C., who are, if properly trained, experts at their work; and in addition a N.C.O. and some eight men from the regiment, who will be instructed on much the same lines as sanitary inspectors in civil life, and this staff of one officer of the R.A.M.C., two N.C.O.'s, and twelve men will superintend the sanitary welfare of the regiment in camp and when on the march. They will give especial attention to the matter of water supply, to the sterilisation of the filtering apparatus of the two new pattern water carts which are to be supplied to each battalion, and will be *au fait* with the best methods of water purification, of disinfection, and of other sanitary procedure.

The sanitation of the mass commences with the sanitary officer on the Divisional Staff, and proceeding backwards to the base concerns the sanitary squads and sanitary sections along the lines of communication, and at the base we have a sanitary company and laboratories, which, with the sanitary committee hovering about where required, complete the personnel.

The N.C.O.'s and men of the R.A.M.C. sanitary department will receive their special training at the schools of instruction arranged for in the various divisions of the R.A.M.C.T.

I am asked to make some remarks on the duties of medical officers when acting in a sanitary capacity. The medical officer of the unit should inspect the food supply every morning, especially the meat, bread and potatoes. He should recommend the early looping up of the tent curtains at fixed hours, and the airing of clothing when the weather permits, and insist on the cleanliness of the lines; and here he will find it an advantage to recommend a small bucket or large biscuit tin to be placed in every tent for the reception of tent rubbish, broken food, potato-peelings, paper, etc.; and at the end of each line a sanitary refuse bin or wire cage to receive the contents of these. He should recommend the provision of urine-tubs in the lines for night use, and be on the look out to prevent greasy or dirty water being cast about the tents, for it attracts flies, and gives rise to smells.

In the case of the wet canteens, the medical officer should not be above sampling the beers and other drinks exposed for sale, and it is wise on these occasions to be accompanied by some man of the R.A.M.C. with a discriminating palate, who will relieve one of tasting some of the samples, for "*qui facit per alium facit per se.*"

An important question, too, is that of providing good palatable and cheap temperance drinks. The ideal temperance drink has yet to be discovered, and a fortune awaits the discoverer; and up till now water pure and unadulterated holds the field; but it seems to me distinctly unfair that teetotal drinks in the canteens should frequently be more costly than beer, and where this obtains it should to my mind be complained of by the medical officer, and the charges reduced. The sale of light beers of the Lager type should be encouraged in preference to the strong and heavy beers.

The canteens and the messes of the sergeants and officers should be carefully inspected, for caterers are notorious for disobeying sanitary regulations if they are not looked after.

In the kitchens the cleanliness of every appliance for storing and preparing food should be insisted on, such as the tables and cooking trays, and the sergeant cook should refuse all tins unless they have been properly cleaned.

The cooks should wear clean clothing, and have facilities for frequent ablutions; the meat tent should have nothing but food stored in it, and the butchers should not be permitted to store their blankets and sleep in it as is too often the case. The chopping blocks should be scoured with hot water and soda after use; these are often very foul, and it is extraordinary that their condition does not foster ptomaine poisoning.

All food should be carefully protected from contamination by flies and dust, ordinary butter-muslin is very useful in this respect.

The inspection of latrines and stables, and the insisting on early removal or destruction of all refuse is most important.

The amount of footsoreness amongst volunteers was really appalling. The men (except those from agricultural districts) are not accustomed to long marches and soon fail and lose a great deal of the training, which, being compressed into a short space of time, is the more valuable to them and to the State; hence the regimental surgeon should take up this matter keenly by urging foot parades daily, and especially after a long march, by recommending thick laced boots for the men, which must be good fitting and with broad toes; they should also have canvas shoes to change into after a long march to rest the feet, and wear thick woollen socks and have a change of the same. The feet should be frequently washed with soap and water, and have methylated spirit rubbed in and dusted with boric powder.

The use of a five per cent. solution of picric acid in methylated spirit is admirable; it is applied to the soles and between the toes by a brush or on a wad of cotton wool on a stick after cleaning the feet and allowed to dry on.

Townsmen should be encouraged to take long walks in preparation for camp.

Before long field days, water bottles should be inspected to see that they are clean and sweet smelling and ordered to be filled, and the men should be cautioned not to empty them at the first halt, but to delay drinking as long as possible, and to be told that gargling and washing out the mouth relieves thirst almost as much as a long drink.

Any spare time the regimental medical officer has, may be devoted to the training of his regimental bearers in first aid and stretcher drill: and in the matter of attending the sick he should insist upon fixed hours or he will have the men dribbling to the surgery-tent all day.

The duties of a sanitary officer specially selected are of a more general nature. He has to accompany the staff officer appointed to select buildings for the use of troops as quarters, hospitals, or stables; to examine these as to their sanitary state as regards cleanliness, ventilation, lighting, water supply, cubic space, lime washing, or in any other respect likely to affect the health of the troops. He advises the staff on these points, and indicates the number of troops which may be quartered in the buildings.

He inspects and reports on the sanitary state of any towns or villages about to be occupied, and makes such comments as are necessary.

He advises in selecting a site for an encampment, basing his opinion on the healthiness of the site, and making recommendations concerning the preparation of the ground; distance of tents and huts from one another; number of men in each tent or hut; ventilation; cleanliness and drainage of surroundings: water supply; location of latrines, and slaughtering places; disposal of refuse and dead bodies.

He examines and reports on the water supply in all its details, quality and sources, and makes recommendations concerning its collection, storage, purification, and distribution.

The sanitary arrangements of camps and occupied towns are under his supervision. He sees to the purity of the water supply and the preventing and abating of nuisances, and he informs himself as to the sanitary condition of all hospitals, houses, huts, tents, and other occupied buildings, and makes the usual recommendations thereon, and reports any dereliction of duty amongst those carrying out sanitary work.

He makes a daily inspection of his camp; he inquires into the cause of any disease appearing and deals with it promptly, and inquires into all matters affecting the health of troops, *e.g.*, food and drink if unsound and scanty, intemperance, clothing, fatigue, exposure, shelter, and such like.

On the line of march he accompanies the staff officer who precedes the troops, and gets all the information he can concerning the district to be invested and proposed camping grounds.

Of course, as a matter of fact, when troops are assembled in moderate numbers for camps of exercise for brief periods only, as the auxiliary forces have been in the past, there has been very little sickness beyond some cases of catarrh, muscular rheumatism, digestive troubles, diarrhœa, and footsoreness, for the simple reason that the training is short, that the men are vigorous and sound, and the season of the year specially selected; but if mobilisation is commanded, and the period of assembly prolonged, things would be very different. When men are called from the towns into large camps, some are bound to have the germs of incipient infectious disease in them, which sooner or later manifest themselves; and in his address at Cardiff last November, the Director-General, Sir Alfred Keogh, gave it as his opinion that if 70,000 men (which he did not consider a very large force) were encamped near a large city like Cardiff, they would have in two or three days nearly 2,000 sick of ordinary sickness, apart from epidemic disease; and he reminded his audience of the experience of the Americans, who mobilised their volunteers for the Cuban war in 1898, and had a large army assembled in Georgia, Florida, Pennsylvania, and Virginia, with the result that in five months there were 20,000 cases of

enteric fever; and in the three years' war in South Africa, the British had some 40,000 cases of enteric. Sir Alfred indicated further how essential it was in warfare to have a strong and efficient sanitary staff to cope with disease, and gave it as his intention, if war broke out during his tenure of office, to flood the army with sanitarians, who would investigate and advise during the conduct of the war, and render a Royal Commission after the war unnecessary.

What can be done by vigorous sanitary measures was well illustrated in the recent Russo-Japanese war, in which the Japanese medical staff took extraordinary precautions in the testing and protection of wells and water-supplies: in the purification of water: in the selection of food, flesh, vegetables, and fruits for the troops, and in sanitary matters generally, with the result that the army suffered but little from dysentery or fever, if the figures of Surg-Major Seaman, the American attaché, are accurate. In the vast force of General Oku engaged in that war, there were said to be less than 200 cases of enteric fever, less than 400 of dysentery, and only forty deaths: whilst by contrast, in the South African war, the British forces lost more than 13,000 men from preventable disease alone.

There will no doubt be scoffing, gibes, and jeers from many combatant officers at doctors' fads when we proceed to carry out strictly our sanitary precepts into practice, but that must not deter us. To be able to cope with the sanitary pitfalls of war, we must perfect ourselves in peace. The gunners and drivers of the Royal Horse Artillery would never be able to gallop to position with precision and promptitude and come into action without long practice, drill, and preparation; and if the sanitary service is not to break down, its efforts in peace must be thorough and exacting, or disrepute and disaster will follow.

It now only remains to speak about those medical officers of health who are invited to join the Territorial Medical Service *à la suite*. It is not intended that they should be compelled to go to camp, though I am sure if camps are located in their districts their presence would be welcome, their advice and recommendations acceptable, and they themselves might see what there is to be learned in camp life. In the event of mobilization, they can relieve one another in their military duties. They would supervise the sanitary conditions of camps in their spheres of influence, and give aid to the P.M.O. and the sanitary staff.

I would express the hope that the medical service of the Territorial force may attract men of learning, zeal, and distinction, worthy of the healing art, and of the traditions and imperial heritage which our gallant forefathers have handed down to us to keep.

Dr. D. S. Davies (Bristol) said that from his experience of twenty years' service in a Volunteer Corps, the necessity for full recognition of the value of sanitary medical service, and co-ordination of the work, was very obvious. Recent experience in warfare had shown the value of such services; and the scheme so ably introduced and explained by the writer would put the Territorial forces in a condition to avail themselves fully of medical skill in safeguarding the health of the troops.

Dr. J. Tubb-Thomas (Wilts C.C.) said he wanted information as to the exact position with regard to the War Office—whether Dr. Jones had been placed in a better position than others to receive information, and was he to be placed in a definite position of authority with a prospect of his recommendations being carried out? Dr. Jones, in his paper, used the word "should" with regard to the duties sketched in his paper; Col. Davies, in his remarks on the paper, used the word "hopes;" whilst Dr. Davies used the word "may." Did that really define the position?

Dr. W. G. Willoughby (Eastbourne) asked if Dr. Arnallt Jones could give any information as to how a medical officer of health at a distance could manage unless the medical officers of health of rural districts gave active co-operation? Unless the medical officers of health of all districts gave help in that direction, the chief medical officer of health at a distance could not do very much that would be effective in the matter of camps, etc. In his opinion, the assistance of all medical officers of health should be asked when the scheme was definitely settled.

Mr. Percy S. Howard (Wanstead) said, in view of the title of that paper, an omission appeared to have been made in what had gone before, in that no remark had been made in regard to the position of the veterinary surgeon in that connection.

It would be readily seen how necessary it was for the examination before slaughter of animals intended for food.

A close co-ordination of the medical officer and the veterinary officer in view of diseases communicable from man to animals and *vice versa* is necessary, in view of the prevalence in past military campaigns of such diseases as psoriasis and glanders; the effect of the former having been recorded in the past as having had a most disastrous effect on an expedition.

Brig.-Surg. Lieut.-Col. A. Wilson (Newcastle-upon-Tyne) asked the writer of the paper if he had had any experience of the arrangement of the nursing requirements of the new force? Instructions had been given that the Field Ambulance Unit, Red Cross Society, St. John's Ambulance Association, and

the new Nursing Service would all take part in the nursing, and the difficulty would be how to bring them all into line without jealousy and without overlapping.

Lieut.-Col. A. M. Davies (London) said he thought that a most important point to be aimed at, in the endeavour to attain effective sanitation of a force mobilised in these islands, was hearty co-operation between the military authorities and the local sanitary experts, that is, the health officers. This would show itself in two ways. The local health officer would, he hoped, not mind deferring to, and learning from, the military authority in matters of Army sanitary procedure, with which (as a civilian) he would very probably not be very familiar; and conversely, the military officer ought to seek information from the local health expert as to questions of water supply, excretal disposal, etc., on which points the local medical officer must almost necessarily be better informed than himself, more or less a stranger to the locality.

Dr. J. Arnallt Jones (Aberavon), in reply, thanked those gentlemen who had criticised his paper on the kindly and generous nature of their remarks, especially those of Col. A. M. Davies, Dr. Davies of Bristol, and the President.

To Mr. Percy Howard he would say that he sympathised with his remarks concerning the co-working of the veterinary and medical professions in the matter of meat supply and inspection.

To Dr. Tubb-Thomas he said that of course one could not at this early stage speak *ex cathedra*, but the paper was based on twenty years' regimental and brigade work, and what was laid down in the Army Regulations. Concerning the duties of the sanitary medical officer, there was nothing official issued from the War Office as yet.

To Dr. Willoughby he said that the sanitary officer would naturally seek the opinion of, and work in harmony with, every medical officer of health whose sphere of work lay in the district or area occupied, or about to be occupied, by troops. It would be a grave error not to avail one's self of all possible information from such a source.

To Alderman Wilson he replied that he did not deal with the matter of nursing because it was foreign to the subject of his paper, and he was not asked to refer to it.

NECESSITY FOR A STANDARD OF CLEANLINESS IN ALL MILKING COMPETITIONS AT AGRICULTURAL SHOWS.

By J. HOWARD-JONES, M.D., C.M., D.Sc.,
Medical Officer of Health, Newport, Mon.
(MEMBER.)

THE extent to which cleanliness is insisted upon by judges and practised by competitors at the leading agricultural shows affords a good illustration of the progress made in this country towards providing clean milk for the public. Competitors would naturally use every endeavour to favourably impress the judges under such conditions, and one would naturally expect that those who are chosen to adjudicate in such competitions would insist upon—(1) Cleansing of the teats; (2) The wearing of clean linen overalls, &c., by competitors; (3) The cleansing of the hands; (4) The rejection of the first flow of milk.

Last year the writer attended the daily milking competitions at one of the leading agricultural shows in the country with the view of ascertaining the conditions obtaining at such competitions.

The first day was devoted to competitions for women over eighteen years of age. Even the idealist or hygienist might be forgiven for overlooking some faults in the methods of such charming competitors as were on view on that occasion. They certainly looked dainty enough; this naturally intensified the unfavourable impression made by the cows owing to their ungroomed condition. With one exception the maids carried clean damp cloths for cleansing the cows' teats, but their ideas of bacterial cleanliness were certainly primitive. Only one rejected the first flow of milk. The others had evidently been brought up on strictly economical principles.

After starting to milk, one maid coaxed the cow by patting her ungroomed flanks with her left hand, thus innoculating the milk with bacillus coli, which had there been preserved in dry culture from time immemorial.

Another fair maid found that the cow's droppings soiled her pail, so the offending particles were first removed with the damp cloth from the

outside of the pail and then from the inner surface, and finally her hands were further cleansed. However, by this time the cloth was somewhat greenish in colour.

Each competitor had to milk two cows. The calculation of the number of bacilli per cc. present in the milk from the last cow of a herd milked under such conditions would require the use of logarithms.

The competition on the last day of the show was open to lads and lassies under eighteen years of age. An opportunity was thus afforded of judging the standard of cleanliness of the rising generation of milkers and of the progress made through the efforts of rural sanitary authorities.

Some of the maids wore linen aprons or pinafores, and some provided themselves with clean damp cloths, but the lads scorned such paraphernalia. Each competitor had a stool, but some of these were cleaner than others and *less* likely to soil the milkers' hands.

It is to be hoped that all competitors had recently washed their hands; certainly there was no opportunity of doing so within the arena, and unless the judges had occipital eyes they could not have seen whether a couple of late-comers had taken that precaution.

One lad wore a linen overall. Three of the maids went through the process of wiping the cow's teats; but one of them laid down the cloth on the well-used straw at her feet and carefully picked it up afterwards in order to clean the second cow's teats. Not one of the competitors rejected the first flow of milk. Why should they? when the results depended partly upon the quantity of milk submitted for the judges' inspection.

One competitor was introduced to his second cow by a judge. With the assistance of his foot he made the cow stand to attention. The udder had just been resting upon an excellent culture of the organisms found in bovine dejecta.

The first cow had not parted with her milk very readily, so the lad was in a hurry, and without any *unnecessary* delay on his part he forthwith started filling his pail, not with milk only though, for he had no time (?) to turn the deep end of the pail towards the posterior aspect of the cow on a certain occasion. Besides, he had noticed that the judge had weighed the contents of his first pail without apparently deducting anything for foreign matter.

The crowd of onlookers were apparently either blind to these details or they recognised them as normal, for their whole attention seemed to be fixed upon the rate of the flow of milk into the pails, the weight produced, and the time taken by each competitor.

It is to be hoped that the judges paid attention to the standard of hygiene of the milker, primitive though it was. From a perusal of the list of prize winners it was evident, however, that the competitors on those days were considered worthy of first, second, third, and even fourth prizes. Some of the milk thus obtained was sold at the official milk stall at the show.

The above facts clearly prove that there is a decided necessity for promoting a higher standard of cleanliness even among the educated milkers of this country, for many of the competitors referred to were ex-County Council pupils.

I therefore move that the Council of The Royal Sanitary Institute be asked to draw the attention of the leading agricultural societies and show committees to the necessity of insisting upon a proper standard of cleanliness in all milking competitions with the view of providing the public with cleaner and more wholesome milk.

Dr. T. Eustace Hill (Durham C.C.) seconded Dr. Howard Jones' motion that the Council of The Royal Sanitary Institute do draw the attention of the leading agricultural societies to the necessity of requiring cleanliness in all milking competitions, and thought that if this were done, and the allocation of the prizes depended on reasonable hygienic precautions being observed by the milkers, more good would be done and more practical education in this important matter afforded to those engaged in the dairy trade than by county council classes or any other means yet devised.

Mr. William A. Dellagana (Southampton) said too much attention had in the past been devoted to the condition of cowsheds and milkers to the neglect of the cow herself.

The cow was undoubtedly the dirtiest animal of the farm; she was generally kept under the most insanitary conditions.

Milch cows should be groomed daily and occasionally washed, as became necessary, so that the best hygienic conditions prevailed at the time of milking. One of the chief difficulties appeared to be the contamination of milk by fæcal matter. He would therefore suggest that, if possible, the cow be made to evacuate the rectum immediately before milking. If this Congress be instrumental in drawing attention to the prevailing want of veterinary jurisprudence in cowsheds, much could be done to rectify the present unfavourable conditions under which dairy cows were kept in this country.

Mr. A. F. Somerville (Somerset C.C.) welcomed the calling attention of agricultural societies to the necessity of conducting milking competitions under such hygienic conditions as would educate the public watching them in the proper way of milking cattle. The agricultural society complained of was

not altogether responsible: the cows were sent by a contractor who took the milk away, none of it being sold in the yard, and the society had no control over it. Under those circumstances the writer of the paper ought himself to have looked after this milk which was taken into his district to be consumed there. There was further great difficulty in getting a sufficient water supply for the place where the competition was carried on.

An important feature in the milking competitions was to insist on milking with dry hands; to allow milk to flow over the hands must pollute the milk.

He promised to bring the matter before the notice of the society in question at the next meeting of its council, and impress upon them the necessity of observing the best possible hygienic conditions in conducting the competitions.

Dr. Herbert Williams (City of London) said that Dr. Howard Jones had done a public service in relating the results of his personal observations at a public milking competition. The point was that if a higher standard of cleanliness was not observed in milking competitions at agricultural shows, where else could you expect to find it? Certainly not in the small dairy farm in country districts, where the process of milking was done without the restricting influence of observation by the public. It was the experience of all London medical officers of health that milk, as it arrived in London, frequently contained quantities of filth, resulting from want of ordinary precautions during the process of milking.

Mr. C. J. Waterfall (Bristol) said that more attention should be paid by the public health authorities to the bacterial pollution of the milk supply. The laboratories of our great authorities dealt too greatly with the amount of fat and total solids in the milk, and to a very infinitesimal extent with the bacteriological and pus conditions that obtained: yet the latter were the most important.

Dr. Edmund Smith (York) suggested that the Council of The Royal Sanitary Institute should urge the agricultural societies to include the hygienic character of the process of milking amongst the conditions upon which prizes were given in milking competitions at shows.

Dr. J. H. Williams (Denbigh) said that the difficulty in securing clean milk in the rural districts arose partly from the reluctance of the magistrates to convict when dirt only was reported to be present. Perhaps the best way would be for the county council to devise means of publishing locally the results of the different milk analyses, with special reference to the amount of dirt present.

Dr. J. Spottiswoode Cameron (Leeds) said that recently in Yorkshire an important inquiry had been undertaken by a conjoint committee appointed by the County Councils of the East and West Ridings, and of the cities and County Boroughs of Bradford, Hull, Leeds, Rotherham, and Sheffield. Their report and

that of their bacteriologist were now published, and could be obtained from the clerk to the East Riding County Council. The bacteriologist found that in specimens of milk collected at the farm and put into ice there was an average of 80,000 colony-producing bacteria. The number of colonies varied from 5,000 to upwards of 1,000,000, and the average was 75,000 in the colder, and 88,000 in the warmer months. For convenience Dr. Orr, in his report to the committee, divided the milks into four classes, those whose bacterial content was less than 15,000, those between 15,000 and 50,000, those between 50,000 and 100,000, and those above the last figure. Grouping the first and second classes and the third and fourth together, it would be found that of the milks where the collector had reported the udders of the cows as clean, 72 per cent. came into the group with bacterial content of less than 50,000, while 28 per cent. only came into the dirtier group. On the other hand, of the cows with dirty udders, 34 per cent. only came into the first group, while 66 per cent. belonged to the dirtier group.

An important part of the investigation, however, was that in which experiments in clean milking of clean cows were made. Dr. Orr found that, employing ordinary farm hands for the purpose, after showing them how to cleanse the cows by proper grooming and then washing the flanks and udders, but leaving them wet, and using properly sterilized milk vessels, the ordinary farm labourer could produce a milk containing only 5 per cent. of the bacterial content of the milks sent to him from farms. He argued that 95 per cent. of the contamination at the cowshed was due to dirty cows, dirty milking, and unsterilized milk cans.

In answer to a question from a member, Dr. Cameron added that the milk taken directly from the udder contained bacteria, especially in the first 25 c.c. drawn.

Dr. J. Howard Jones (Newport) said that Mr. Somerville's suggestion that the milk in question should have been seized was, of course, intended as a joke, for medical officers of health had experience of the difficulty of obtaining convictions in prosecutions under the Cowsheds, etc., Regulations.

Not long after the above incidents, prosecutions were instituted against dairymen under the above regulations; the teats of the cows and hands of the milkers were wiped with clean linen cloths; these cloths became filthy in consequence, but even such a practical demonstration was not sufficient to procure a verdict, and the cases were dismissed.

It had been suggested by Dr. E. M. Smith that the rules of cleanliness be added as a rider to the resolution proposed, but personally he preferred leaving the details to the Council, who were quite competent to deal with the matter.

TYPHOID CARRIERS.

By WILLIAM ARCHIBALD, M.D.Glas., D.P.H.Camb.
Assistant to the Medical Officer of Health, Glasgow.

WHILE many of the great problems of epidemiology may be said to be still unsolved, much has been done recently to bring them nearer solution. Contagia have been traced to their habitats outside the body; the conditions and surroundings under which the organs proliferate have been ascertained; the changes through which they pass, when conditions vary, have been followed up, and many factors inimical to their growth have been discovered. A complete and satisfactory explanation of all the peculiar variations seen in infectious diseases, and in their spread, is still remote, but the present results have shown the paths we must rely on to conduct us to a successful issue.

The position is bristling with difficulties, as, to mention only a few factors with which we have to contend; variations in temperature, air supply, light, food, etc., each exercises such a marked effect on the ultimate result, that the compilation of the results of all these acting together seems, at present, almost impossible.

In enteric fever we have a disease which is recognised by all writers on the subject as peculiarly one in which the infection is water-borne. Occasionally one meets with an example of enteric being spread by direct personal contact, but these instances are rare.

The relation between the excreta of enteric fever patients and the spread of the disease has also long been recognised, and more recently it was discovered that the urine might also transmit the infection. It has only quite recently been shown that in a limited proportion of persons recovered from the disease, the bacillus may maintain a prolonged existence. These cases are apparently those in which complications in connection with the gall-bladder have occurred, and seem to be most commonly met with in females. Assuming that the organism gets installed in the gall-bladder, on being voided by the bowel, these patients become capable from time to time of transmitting the disease to others.

Such a carrier case would appear to have been the cause of an epidemic of enteric fever, amounting to 126 cases, which recently occurred

in Glasgow and neighbourhood, and a resumé of this epidemic would probably serve as an excellent introduction to a discussion on the subject of carrier cases, while at the same time it would illustrate the difficulties which have to be surmounted in dealing successfully with an epidemic.

Before dealing with this epidemic in detail, however, it may be advisable to mention here another class of infective person occasionally met with. I refer to those fortunately rare instances where a patient, after recovery from an attack of enteric fever, continues for a time to shed typhoid bacilli in his urine or fæces. An example of such a case came under notice as these notes were being prepared, and the particulars have been appended as having some bearing on the subject under review. This latter, or "physiological" carrier must be carefully distinguished from the "pathological" carrier who, as mentioned above, is only occasionally infective.

The following particulars are summarised from the report on this outbreak by Dr. Chalmers, Medical Officer of Health:—

The Cases as Notified.

The first notification was received on December 17th, two others followed on the 18th and 19th, and again on the 23rd and 27th two more were received. At this point an interval of six days occurred, but on January 3rd a series began which was practically unbroken until the outbreak ceased.

The interval is important. It separates the notification of five cases irregularly distributed over eleven days from a series of others which present the true characters of a milk-borne epidemic, in the rapid increase in the numbers notified daily and in the numbers sickening simultaneously.

The significance of this interval will be better appreciated when considered in the light of the dates of sickening of the cases notified before and after it occurred.

The Dates of Sickening.

The five cases notified during December sickened between the 8th and 14th of the month. One case had already occurred among the Partick consumers on December 5th, and another sickened on the same day as the first two Glasgow cases. In the early part of December the sicknesses were infrequent and irregular, and it was only after the close of the week ending 21st that they began to be of daily occurrence. Indeed, the mass of infection represented by the sicknesses which occurred after this date and reached their maximum daily number towards the middle of the fortnight

ending January 11th, was in striking contrast with the irregular distribution of those sickening early in December.

It suggests two distinct waves of infection, and subsequent inquiry showed not only that this would appear to have occurred, but that the source of each was fairly distinguishable.

THE NUMBER OF PERSONS ATTACKED.

Excluding four cases which were secondary to others occurring at an earlier date in a corresponding number of households, 92 cases were registered as occurring in 79 households of consumers in Glasgow, there being 10 households in which multiple primary infections, 23 in number, occurred.

Among the Partick consumers Dr. Brown reported that 21 cases had occurred, and I had information regarding 13 others who only sickened after leaving Glasgow. In 8 of these 126 cases the attack proved fatal.

The number of consumers of this milk in the 500 households receiving it is not known, but the number of inmates therein may be put at not less than 2,500, and on this basis the attack-rate lies between 4 and 5 per cent., while the case fatality-rate has been equal to 5·5 per cent.

THE SOURCES OF THE MILK SUPPLY.

The milk distributed from Flemington Farm was received from five other farms, and the quantities from each were as follows:—K. (Paisley), 70 gals.; S. (Anniesland), 60 gals.; A. (Balfron), 70 gals.: G. (Beith), 20 gals.; Parkhouse, 40 gals.

A sixth farm had ceased sending milk on December 5th. As the milk from Balfron and Beith arrived too late for the morning's delivery of the day of arrival it was sterilised. The milk of the three remaining farms, K., S., and Parkhouse, was not sterilised before the morning delivery, and whether any of it was ultimately so treated depended on the daily fluctuation in the demand. The channels by which the milk from these several sources reached the consumers will emerge in considering the order in which the several deliveries became implicated.

THE INCIDENCE OF ATTACKS ON THE SEVERAL DELIVERIES FROM FLEMINGTON.

All the cases notified between December 17th and January 6th obtained their milk from cart D. Our information at this time was that the morning milk of this cart had been obtained from the Anniesland farm prior to 29th November, and from the Paisley farm thereafter. The first sickening, however, occurred in Partick on the sixth, and three others,

including two in Glasgow, on the ninth day after this change had taken place, and as the duration of the incubation period of the disease is, in the majority of cases, about fourteen days, it was provisionally regarded as unlikely that the Paisley farm milk was the source of infection. This opinion was ultimately established by a report from the Medical Officer of Renfrewshire that no illness was present there.

The Anniesland farm milk, at the beginning of the inquiry, was being distributed partly in the district of Temple and partly in Hillhead and neighbourhood.

The portion delivered in Temple was sent direct from the Anniesland farm, whereas that which was delivered in Hillhead was taken, in the first place, to Flemington Farm, and thereafter sent out in carts other than cart D. In neither of these sections of its distribution was there evidence of infection.

But when it became apparent early in January that sicknesses were also occurring among the customers of the other carts the information first given was corrected, and we were told that the portion of the Anniesland farm milk distributed by cart D. prior to November 29th was frequently supplemented by milk from Parkhouse. This is more fully described hereafter.

It was possible, of course, that the portion of the Anniesland milk distributed by cart D. prior to November 29th had become exposed to contamination only after reaching Flemington Farm, but the early enquiries definitely excluded from suspicion both the family and resident employees at Flemington Farm, as well as the driver of the cart and the boys who accompanied it as carriers.

On January 6th and 7th, however, two sickenings were notified among the customers of cart McG., on January 9th one was notified on cart McA., and on January 11th two were notified on the service of the boy carrier from the farm, and one on the Hydepark portion of the supply.

And if, instead of the dates of notification, we take those of sickening, it will be seen that, while cases began to occur among the customers of cart D. as early as December 5th and 8th, none occurred among the customers of the other delivery services until December 19th, 23rd, 25th, and 30th respectively.

It thus became important to discover whether any antecedent change had occurred in the distribution from Flemington Farm which would explain the extension of infection from cart D. to the other deliveries, which the notifications received between January 6th and 11th disclosed.

For this purpose it is necessary to revert to the information first obtained regarding the farm from which cart D. obtained the milk for its morning delivery.

As already stated, this was said to have been from the Anniesland Farm prior to November 29th, and this in a sense expressed the general practice. But when revised, in view of the attacks occurring among the customers of the other carts, it was ascertained that the Anniesland milk fell short of the quantity required for cart D.'s morning delivery about three times out of seven, and was on these occasions supplemented by milk from Parkhouse Farm in quantities varying from 8 to 10 gallons out of a total of about 40 gallons obtained from this source.

Moreover, as it was the object of the purveyor to supply as much non-sterilised as was available for the delivery of cart D., the remaining quantity of Parkhouse milk was, by preference, reserved for the mid-day delivery of this particular cart, until the introduction of Paisley milk, on November 9th, set free Parkhouse milk for distribution also by the other carts in their morning deliveries.

Indeed, until after November 29th, the other carts, in these morning deliveries, mostly delivered sterilised milk from the other farms.

On the hypothesis, therefore, that the Parkhouse milk was the vehicle of infection, the limitation of the attacks to the customers of cart D. at the beginning of the outbreak, and the ultimate implication of all the delivering channels would have reasonable explanation.

Relation of the Parkhouse Illness to the Outbreak in Glasgow.

We have now to consider the relationship of this case at Parkhouse to the outbreak in Glasgow, and particularly to the two waves of infection which have been suggested. The patient at Parkhouse remained unrecognised as suffering from any infectious disease from December 7th to the 24th, and it is reasonable to associate her illness with the true epidemic incidence in Glasgow, which culminated towards the middle of the fortnight ending January 11th. But it will not explain those prior to December 14th, and would only explain those sickening on December 19th and 20th by assuming the coincidence of an unusually early accession of infectivity in the Parkhouse patient, and an unusually short period of incubation in the four cases then sickening. But with regard to attacks which developed after the week ending 21st December there is no difficulty, and the illness at the farm may be regarded as

sufficient to explain those occurring among the consumers after this date. But the Parkhouse patient is apparently one of the earlier group of sicknesses which began on the 5th December, and cannot, therefore, have been the source of infection of the other members of this group.

Coincident but independent sources of infection for herself and the others might, of course, be suggested, but it is more important to consider whether evidence exists to support the suggestion that she sickened because she was herself a consumer of milk distributed from Flemington Farm.

That she was in this sense an occasional consumer seems likely, from the circumstance that it was part of her brother's morning work, on his return journey from Flemington, after delivering his milk there, to take about ten gallons to the Hydepark Locomotive Works Cooking Depot, and any occasional surplus not required at the Depot was taken on to Parkhouse by him, and there consumed.

If, then, the Parkhouse illness could be ascribed to this returning stream, the larger quantity delivered at Hydepark Works would be likely also to have produced somewhat similar results. And while it is true that cases did ultimately develop among the consumers at Hydepark, the first sickness there began only on the 30th December, or fully three weeks later than the Parkhouse illness. In other words, the Hydepark cases belong to the later epidemic wave, and not to that which began on the 5th December.

And, as matter of fact, it was only after unsterilised milk from Parkhouse began to be occasionally delivered to Hydepark that cases developed among the consumers there, and this date can be definitely fixed as not earlier than December 5th, and may have been some days later.

The Position of the Parkhouse Illness among the First Group of Cases.

Although occurring contemporaneously with the early sickenings among the Partick and Glasgow customers of Flemington Farm, it may be suggested that the patient at Parkhouse was infected from a different source. This seems scarcely tenable, in view of the fact that the others were on a common milk supply, that this was occasionally at least obtained from Parkhouse Farm, and that the farmer's family there used their own milk. Infecting material at the farm gaining access to this milk before it was despatched to Flemington would explain both the Parkhouse case and the others. But of the source of this the evidence was not immediately forthcoming.

Report by Dr. Buchanan, Bacteriologist.

"On making inquiries at this farm, attention was attracted to a milker, a young man, who had suffered from an obscure illness consistent with enteric fever about three years ago, and who had some possible association, on more than one occasion during 1907, with enteric fever outbreaks. It was found, however, that any suspicion attaching to this milker was soon set aside by the bacteriological tests, which entirely failed to substantiate it. Subsequently it was discovered in the course of investigations at the farm that another milker, an elderly woman, had a history of previous associations with enteric fever which attached suspicion to her with still more probability as a source of the infection which had contaminated the milk.

This milker suffered from enteric fever, along with most of her family, sixteen years ago, and had now and again since that time been associated more or less closely with outbreaks of illness which proved to be enteric fever. She was taken into Lightburn Hospital for a few days in order that reliable specimens of the dejecta and urine might be obtained for bacteriological examination. Dr. Wilson very kindly afforded every facility for a thorough investigation by supplying as many specimens as were required for the bacteriological tests. These tests have resulted in the discovery of the bacillus of enteric fever in the dejecta, and in establishing the existence of a source of infection which, doubtless, directly accounted for the early cases of the outbreak, and indirectly gave rise to the epidemic wave. The bacillus did not appear in great number in the dejecta, a rough estimation computing it at 5,000 per cubic centimetre. Her blood gave a positive Widal reaction with the laboratory strain of *Bacillus typhosus.*"

It may be observed that bacteriological research has revealed the fact that persons passing through an attack of enteric fever, as a rule, give off the infection (the *Bacillus typhosus*) by the intestine, and frequently also by the urine, during some stage of the illness. The bacillus may appear in the stools as early as the first day of illness, although the largest percentage of cases yield it in the second and third weeks of the disease. It may continue to be shed throughout convalescence in a certain proportion of patients; while in a small residuum of cases, probably about two per cent., the germ takes up a lodgment in the body, and continues to be excreted for months or years, or, it may be, throughout life. These chronic typhoid carriers are a discovery mainly of the last two years. They have been found at periods ranging from ten weeks to forty-two years after the attack of the fever. Moreover, several instances are

recorded of persons acting as carriers of the infection in this way, although they never had any clinical manifestation of the disease, or had no recollection themselves of being ill. It is to be remembered, however, that enteric fever is often very slight or obscure in its manifestations, and has sometimes been regarded as influenza, pneumonia, bronchitis, rheumatism, meningitis, or neurasthenia. Amongst chronic typhoid carriers, women form by far the largest proportion (about 75 per cent.) The bacillus in these exceptional carrier cases finds a lodgment in the gall-bladder, from which it passes to the intestine, to be voided with the intestinal dejecta.

This persistence of the *Bacillus typhosus* in certain persons for so many years after an attack of enteric fever is a matter of great importance from a public health point of view; for such persons, acting as unsuspecting and unsuspected carriers of infection, communicate the disease to others.

During the present fortnight a return case occurred in connection with the dismissal from hospital of an enteric fever patient, and the facts are interesting as illustrating the method by which infection may be conveyed.

On May 6th a male patient was dismissed from Belvidere Hospital recovered from enteric fever, for which he had been under treatment from March 13th. His household consisted of his wife and two children, and on June 13th the wife sickened of enteric fever, for which she has since been removed to hospital. The circumstances led to a bacteriological examination of the excreta, with the result that the organism was recovered from the urine.

The possibility of infection by this means has for some years been recognised, but it happens only rarely that a concrete illustration is obtained, and it has been thought desirable to draw attention to the case. This instance is also instructive from the point of view that the carrier was a male, and not a female, as is usually the case.

[*For Discussion on this paper, see page 595.*]

TYPHOID CARRIERS.

By WILLIAM G. SAVAGE, M.D., B.Sc., D.P.H.
Medical Officer of Health, Colchester.

IT is very important to have clear ideas as to the nature of typhoid carriers and their probable danger as distributors of infection. Two distinct types have been described: *Acute carriers* or, as I prefer to call them, *contact* carriers; *Chronic carriers* or persistent carriers.

Under certain circumstances, typhoid bacilli have been found in the excreta of healthy persons who apparently have never suffered from typhoid fever. These are the contact carriers. These persons have been in contact with cases of typhoid fever, generally more or less intimate contact, and their occurrence is analogous to the contact carriers of diphtheria.

Since cases of typhoid fever are sometimes very mild, there is naturally some doubt as to whether some of the contact carriers found are not really very mild unrecognised cases of typhoid fever.

At present we have but little evidence either as to their numerical prevalence or the duration of their infectivity. Klinger at Strassburg found eleven such cases out of 1,700 healthy individuals examined in the course of one and three-quarter years. In nine instances they were only once found, while in two they were found on more than one occasion.

The chronic or persistent carriers belong to a different category. The older conception, in regard to the infectivity of typhoid fever, was that the bacilli disappeared from the body, if not at a period coincident with the cessation of clinical signs, yet at an early date.

Extended bacteriological investigation has established the fact that typhoid bacilli may persist in the body and be found in the excreta for extended periods, in certain cases persisting long after all clinical signs have vanished. The persistence may last from a few months to a lifetime. These persons constitute the chronic carriers.

In these remarks upon this very important subject I do not propose to offer any facts in support of the existence of these carrier cases. With available evidence we must accept their existence as *proved*.

Accepting this fact, the main object of discussion, as practical medical officers of health, is naturally to try and measure the probable danger from this source, and to arrive at some ideas as to the appropriate action required. The following remarks deal only with these aspects:

Dealing with *contact carriers* our available knowledge is scanty, but provisionally it seems a reasonable supposition that they do not play a great part in the dissemination of enteric fever. The bacilli seem to be few in number and not present for any length of time, while such contact carriers are apparently not numerous.

Dosage and facility for infection are very important factors in typhoid infection. With present knowledge it is a reasonable assumption that they are in no way as important as disease spreaders as the contact carriers of diphtheria.

The persistent or *chronic carriers* are probably of much greater importance. Not overstating the facts, in probably about 3 to 5 per cent. of cases of typhoid fever the typhoid bacilli persist for very long periods, constituting these chronic carriers.

Going beyond, however, the mere presence of typhoid bacilli, we have to ask ourselves: Do these cases in practice spread typhoid fever? Can they spread typhoid fever?

It may be argued, for instance, that the fact that typhoid bacilli are excreted from time to time does not prove their infectivity; the bacilli may be without virulence to man, and incapable of causing typhoid fever.

Hamer, for example, in a very able paper recently published,* has suggested that the finding of carrier cases amongst a series of persons examined in connection with an enteric fever outbreak is nothing more than what might be expected, any so-called carrier case found not being the cause of the outbreak, but an individual infected at the same time as the actual cases causing the investigation.

The actual proof of the infectivity of carrier cases for man must rest upon the individual recorded outbreaks due to such cases. These are gradually increasing in number, and a new one has been brought forward to-day by Dr. Archibald, while a most striking and convincing outbreak by a carrier case has been recorded by Dr. Davies and Professor Hall.

In addition to the actual outbreaks, certain bacteriological and other facts are worthy of attention in this connection.

The bacteriologist has shown that the organisms isolated from these chronic cases are undeniable typhoid bacilli identical in every way with bacilli derived from an acute case. They are further lineal descendants of bacilli which have caused typhoid fever. It is a reasonable assumption that they can cause disease, and the onus of proof hardly rests with the bacteriologist.

It is well known that outside the animal body pathogenic organisms

* Proceedings of Royal Society of Medicine, Epidemiological Section, Vol. I., April, 1908.

lose their virulence and are then incapable of setting up disease, but it is also in general true that within the body virulence is retained, or at least for a vastly longer period. Typhoid bacilli which have almost lost their virulence can be restored to active pathogenic power by repeated passage through the animal body. Pneumococci in an actively virulent condition for mice persist in the buccal cavity of many individuals, and judging from clinical experience cause marked pneumonia when the tissue resistance is lowered, enabling them to infect. In the same way in latent tuberculosis the bacilli apparently retain active infective powers for very long periods. If auto-infection takes place there is no reason why infection of others should not occur, and by analogy there is no reason why typhoid bacilli should not remain actively virulent for indefinite periods.

In diphtheria, as is well recognised, diphtheria bacilli may remain in an active virulent condition for a long time in the throat and nose of recovered cases. From the evidence of return cases of diphtheria, we know that such cases may be infectious to man for very long periods.

These facts are of some interest because at the discussion upon this subject at the Epidemiological Branch of the Royal Society of Medicine several authorities seemed to consider it doubtful how far these carrier cases could set up typhoid fever. They advance the fact that carrier cases (*e.g.*, Dean's) have been found of long duration, and which so far as known have not infected anyone. Also, if these carrier cases were infective, then we should get much more typhoid fever than exists in this country.

Dealing with the first objection, it is obvious that it cannot be accepted that because no cases were known therefore none had been caused. Infection might have been widespread through sewage water, soil, etc., and the actual source of the bacilli missed, possibly because not looked for.

The second objection does not take sufficiently into account the inherent difficulties of typhoid infection. In ordinary cases of typhoid fever, the stools are directly handled by persons other than the patient. Such attendants of necessity handle much infective material, and are almost certain to get infective matter on their hands. It is only by scrupulous cleanliness that personal infection is avoided, and we cannot wonder that it occurs.

But the chronic carrier is not ill. He himself is immune, and his excretions are not handled by outsiders. The chances of his serving as a personal infective factor are in this way immeasurably lessened. Added to this we have the fact that the bacilli are only intermittently excreted, perhaps at very long intervals.

In other words, even if we postulate that the bacilli are exceedingly

virulent and capable of causing enteric fever, we should hardly expect these cases to directly set up the disease unless such persons are, on account of their position, brought into contact with food which they can contaminate. Such a condition is just what is found. The chronic carriers which can be proved to be concerned in directly spreading disease are those which handle food.

Stated another way, I would suggest the view that the available facts are naturally explained upon the supposition that the carrier cases are undoubtedly *potential* sources of typhoid fever. They are all *potentially* infective, but the number of cases of typhoid fever due to them is limited on account of, on the one hand, the inherent difficulties of infection, and on the other, the intermittent discharge and possibly small dosage.

The question of dosage is important, since it seems probable that a fairly large dose of typhoid bacilli is necessary for infection. In diphtheria probably a few bacilli can set up the disease. In typhoid fever, on the other hand, the bacilli have to run the gauntlet of the gastric juice and the juices of the small intestine, and many ingested bacilli are doubtless killed before a suitable nidus is obtained. In this way dosage is material.

If these suppositions are accurate, then while any chronic carrier must be considered a potential source of harm, he is an *active* danger in particular when in a position to directly foul food, and especially such a food as milk, in which typhoid bacilli thrive abundantly.

The probability of the existence of persistent carriers would be indicated in a good many of the cases if they were bacteriologically examined on at least two occasions before discharge from hospital. In addition, such cases should be kept in hospital for rather longer than usual (two to three months), and the last examination made just before discharge. Of course, however, all chronic carriers would not be recognised by this procedure, but probably most would be indicated.

Special care should be taken to follow up all such chronic carriers, and their removal to other districts should be duly noted and notices sent on to the local medical officer of health. This might have to be carried on for years. Occupations which involve the handling of food should be forbidden to such known chronic carriers.

As a practical point I would suggest that in the examination of the excreta of cases ordinary stools be not examined, but those obtained as a consequence of the administration of a cholagogue, such as calomel.

As far as I know there are no available medical means by which the bacilli can be eliminated from the system.

[*For Discussion on this Paper, see page 595.*]

TYPHOID CARRIERS.

By D. S. DAVIES, M.D., D.P.H.
Medical Officer of Health, Bristol.
(FELLOW).

SINCE the publication of the account of the Brenty and Brislington outbreaks of typhoid fever, by Dr. Walker Hall and myself, in the Transactions of the Royal Society of Medicine (Epidemiological Section), in April, further particulars of interest have been observed with regard to the woman who had been associated as a carrier with these outbreaks: and also a fresh instance of carrier infection has come to light in Bristol.

It will be remembered that the carrier in the Brenty outbreak was admitted to the institution (an inebriate home) as a patient in April, 1906, put to kitchen work soon after admission, and on to dairy work in October. Between October, 1906, and November, 1907, twenty-eight cases of typhoid fever and two deaths occurred amongst those inmates of the home and officers who had special access to milk, whether they resided on or off the premises. Mrs. H. had had typhoid in 1901, but was to all appearance in 1906–7 in perfect health; all milk passed through her hands. Suspicion fell on her in November, 1907, and she was excluded from food-work as an experiment; her exclusion was followed by complete cessation of the typhoid fever.

Her history was then searched into for further corroboration. A striking instance was found in the case of a typhoid outbreak which occurred at a home for girls at Brislington, near Bristol, in 1904, which was unexplained at the time. *The same woman* had been taken on as cook in February: nothing happened until May, when a series of cases of typhoid fever occurred amongst the girls, attacking nearly every one, with two deaths, and lasting until the cook left and the home was broken up. Lastly, in 1905, she was taken on as cook at a third home for girls in Clifton in March; nothing happened until May, when one of the girls sickened of typhoid fever.

After this woman was isolated in November, 1907, she was kept strictly secluded, and away from any food preparation, and her excreta were examined from time to time. She was first proved to be a carrier on

December 20th, when typhoid bacilli were recovered from her stools: they then remained free until April, when the bacilli reappeared and continued to be found during May. In June, 1908, though unable to infect others, she succeeded in infecting herself, passing through a slight attack, in which condition of stools, temperature, pulse, and general condition indicated an auto-infection with typhoid.

The second person found to be a carrier in Bristol was the mother of a family of five children. Her husband died of typhoid fever in October, 1907, and nothing further was reported until the first week of June, 1908, when four of the five children were notified almost simultaneously as suffering from typhoid fever. On inquiry it was found that the mother, the food preparer, had herself suffered from symptoms very suspicious of typhoid fever shortly after her husband's illness in October, but a negative Widal result had led to non-notification. This woman's blood gave a *complete* and immediate Widal reaction in 1-in-200 solution. Professor Walker Hall is at present engaged in further pathological inquiry.

Periodicity.

A point of considerable interest is the period of time at which, in the instances quoted, the outbreaks tend to commence. Thus, in the 1907 Brentry outbreak, in the 1904 Brislington outbreak, in the 1905 Clifton outbreak, in the 1908 auto-infection, and in the 1908 case, effectivity was not manifested until May or June, although opportunity of infection was not wanting in the earlier months of the year.

The full meaning of this periodicity, and the extent to which the apparent law may hold in future instances, can only be surmised at present.

The Importance of the Food Preparer.

It is now well known that many carriers may prove ineffective over a long series of years, but this is not to be wondered at if they are not engaged in food preparation or in dealing with milk. It seems certain that infection is conveyed into the food or milk by the hand more or less directly, after attending to the calls of Nature, and omitting to wash the hands.

The personal factor in endemic typhoid infection is probably of far greater importance than is usually recognised, and the May periodic recurrence of infectivity in carriers may pave the way for the subsequent autumn wave of typhoid prevalence, and for the water infection or milk outbreak which may then take place.

Prophylaxis.

Obligatory cleansing of the hands amongst cooks, dairymaids, and raw food preparers of every kind is obviously essential, and in institutions can be readily enforced.

Physicians should consider arrangements for the after-care of typhoid convalescents, and some control over their condition should be for a time maintained. State control may be anticipated with regard to food factories. As to cure, surgical attention to the gall-bladder, the seat of the harboured bacillus, has in one instance proved successful, but is too drastic a process to recommend. No drugs are as yet known to be effectual; but bacterial methods may prove to be available. The whole subject needs full consideration, and must be carefully worked out and studied as instances arise. These instances will probably be sufficiently frequent if they are carefully and systematically looked for.

[*This Discussion applies also to the Papers by* Dr. Archibald, *page 581, and* Dr. Savage, *page 589.*]

Lieut.-Col. A. M. Davies (London) said he was fully convinced of the importance of the carrier theory, but thought personal infectivity could not be universally admitted. At present measures of isolation were not habitually practised in general hospitals in regard to enteric cases, and yet spread in hospital was very rare. A large experiment was carried out during and after the South African War, when for very many months large numbers of convalescent enteric patients returned to this country. Many of these must have been excreting enteric bacilli, and were theoretically infective. No outbreaks, however, occurred in barracks at Home Stations (with one exception) that could be referred to personal infection. The absence of spread by direct infection in past years, and at the present time in general hospitals treating enteric cases without isolation, might be explained either (1) by variation in individual susceptibility to the diseased poisons ingested, or (2) by variation in virulence of the bacilli excreted. With regard to (1) it was within everyone's experience that some persons were much more liable to catch infectious disease than others. With regard to (2) he thought that special outbreaks such as had been described by Dr. Davies at Bristol were probably due to this cause, an exaltation of virulence in a particular strain of enteric bacillus, the cause or causes of which would be special change of environment, *i.e.*, factors in evolution.

Dr. W. C. Hossack (Calcutta) said Colonel Davies had called attention to a point in bacteriology to which perhaps too little attention had been paid in the

past, the small relation frequently borne by the amount of infection to the amount of infective material and the opportunities of infection. In other words, the constitution of the patient, the medium of development, was quite as important as the presence of the bacillus.

That was particularly well exemplified in Calcutta in the case of two special diseases, plague and cholera. Of these the latter was the more important. In both diseases, with continued opportunities of infection, it was the exception for more than one case to occur in a house; 75 per cent. of the cases occurred singly. That was most striking in the case of cholera, where it was certain that all the numerous inhabitants of the area round an infected tank were continually exposed to infection, considering their domestic habits and the fact that the tanks were used for all household purposes. In most cases, when the water of presumably infected tanks were examined, the cholera bacillus was recovered.

These striking instances must bring it home to everyone that the bacillus was very far from being the sole determining factor in disease, and that more attention might well be paid to the aspect of infection.

Dr. E. M. Smith also took part in the discussion.

THE ADMINISTRATIVE CONTROL OF ANTHRAX.

By F. W. EURICH, M.D.,

Bacteriologist to the Anthrax Investigation Board for Bradford and District.

IN introducing this subject for discussion, I shall restrict myself to the consideration of anthrax as it affects man, without, however, wishing thereby to lay a similar restriction upon those who follow. And as my own experience lies mainly in the sphere of industrial anthrax as it obtains in the wool industries of Bradford and district, it will be only natural if my remarks will, in the main, bear upon this part of the subject.

The vast majority of cases of anthrax in man are contracted in the various industries which necessitate the handling of wool, horse-hair, bristles, skins and hides. All such cases are notifiable.

The question has recently been raised whether the notification of cases of anthrax other than industrial, should be made compulsory. The object of such a regulation would scarcely be the prevention of the infection of man from man. This is a rare event, though I have seen conditions which would favour such an occurrence, as, for instance, the soaking of shirt and bed-linen with the serous discharge of a malignant pustule on the neck, without any attempt at disinfection. The value of the notification of sporadic, non-industrial cases, would lie in tracing the source of infection. The notification of anthrax in cattle is, in many rural districts at least, in by no means a satisfactory state. Professor Delépine, of Manchester, for instance, has shown in his study of outbreaks of anthrax in Cheshire, that there must be a considerable leakage.

Turning to industrial anthrax, it will be found that most of the work on the subject has been done (in this country, at all events) in connection with the cases that have arisen in the centres of the wool industries. Ever since the introduction of Eastern wools some 70 years ago, cases of so-called blood-poisoning had been noted among the operatives engaged upon this class of material, and especially among the sorters. The credit

of identifying these cases with the anthrax of cattle belongs to the late Dr. J. H. Bell, of Bradford, and to Prof. Greenfield. As a result of their labours certain recommendations, for the treatment of dangerous wool, were made by the Health Committee of the Bradford Corporation. These were ultimately embodied by the Government in its regulations for wool-combing and wool-sorting, and further revised by the Home Office in December, 1905.

Though the practical outcome of the precautions taken during the past 25 years has been a great diminution in the number of cases reported, yet the results obtained have not been as satisfactory as had been hoped. A curious change has also come in the class of workers attacked. Twenty-five years ago the openers and sorters were most frequently the victims; now those suffer oftenest who are engaged in carding and combing, in manipulations of the wool after it has passed through the wash-bowls.

Investigations up to 1905 had established the connection of anthrax with the manipulation of foreign wool and hair, but had failed to definitely locate the poison. Professor Greenfield confessed that in spite of numerous experiments, his examination of wool and dust had proved negative. Looking through the numerous reports on cases, preventive measures, &c., of the last twenty-eight years, one must be struck with the uniformity with which dust, without any further specification, is declared to be the vehicle of infection. It would seem as if the experiments of Koch and Pasteur relative to the anthrax germ in soil had given a certain bias to our views. It was held that a fleece may prove dangerous to man, even if it came from a healthy animal, in virtue of the dust which it holds. When, therefore, the Anthrax Investigation Board began its labours in the autumn of 1905, one of the first problems to which I applied myself was to determine, if possible, the infectivity of wool, and of dust taken at random from under the sorting board, and from the willowing-machine. My examinations now number over 600, and I have not been able to satisfy myself that dust derived from the soil is an important factor in the dissemination of the disease.

Like Professor Greenfield, I have not once been able to discover the germs of anthrax in such samples; but I *have* found anthrax in 15 per cent. of the blood-stained wool and hair up to the present. It would therefore seem that though infection by means of dust, free from blood, may be possible (we all know the difficulty of proving a negative), it sinks into insignificance when compared with the possibilities that lie in a blood-stained fleece. Let an animal be found by the herdsman to be seriously ill; its throat is cut, the entrails removed,

and the flesh probably used for food. Or, vultures tear the scarce dead body of some fallen beast. In either case the wool or hair becomes contaminated with the germ-laden blood. It seems obvious, yet it has till now escaped remark. Nowhere will you find any mention of the importance of the presence of blood as an index of possible danger. The Government's regulations for wool sorting and wool combing, too, contain no direct reference to it. It may be that those who framed these rules took it as self-understood when employing such terms as "damaged wool" and "fallen fleece" and enjoining special treatment of such. The wool combers certainly do not understand these terms to include blood-contamination; they attach special meanings to these terms. "Damaged wool" is, to them, in the main wool that has been damaged by sea-water. A "fallen fleece" is characterised by having wool or hair of dead, lack-lustre appearance, and having a musty or even putrefactive odour, being evidently derived from an animal that had perished some time before its discovery. It may, of course, have been mangled by vultures, and if it had died of anthrax the fleece may be tainted with the infected blood, but unless its blood had been spilt in some such way within 36 to 48 hours after death there would be little or no chance of any subsequent infection of the fleece, for putrefaction destroys the bacillus of anthrax. The presence of blood on fleece or locks has therefore not been looked upon with suspicion as being derived from a dead or dying animal. It is evident that the term "fallen fleece" has had a too restricted application.

What has happened, then, till recently, has been that the blood on the wool, if recognised as such, has been thought to be due to careless clipping: the blood-stained wool has been allowed to pass muster, and the tainted material has thus been put into the wash-bowl with the rest. The matter would not be so serious if we could be assured that the adhering germs would in great part remain behind in the wash-bowls, while the rest would be so distributed in the wool as to ensure a dilution of the poison that would render infection highly improbable. Unfortunately such an assumption is untenable. In the first place it can be shown that quite appreciable pieces of blood-clot will detach themselves from the wool-fibre in the bath, only to be caught up again when the wool is removed from the wash-bowl; the subsequent process of drying will, of course, simply fix such a clot once more to the fibre. Secondly, many of the spores of anthrax are so firmly glued to the wool or hair, that such washing as the wool is subjected to in the wash-bowls will still leave them in position. This probably explains the relative frequency with which carders and combers contract the disease, as compared with sorters. The regulations have

certainly benefitted the openers, sorters, and wash-bowl feeders, but have not greatly lessened the risks to which those are exposed who handle the work after it has been washed.

To safeguard all the operators the ideal procedure would be the use of a disinfectant applied in such a way as to insure disinfection of all parts of a bale. We have three or four disinfectants that will kill anthrax in the test-tube, and the use of which would be commercially possible: but their application is by no means satisfactory. Penetration is the difficulty. Even if we could ensure saturation of the healthy fleeces within the bale (and we cannot even do this at present) we can scarcely expect the liquid to penetrate in sufficient quantity and to a sufficient depth into the hard-baked, compact masses of fibre, clot and dirt which hold the spores. I have taken two fragments, each measuring about 1 ccm., from such a piece of matted wool in which I had previously proved the presence of anthrax spores, and put them into baths of 1 per cent. and 2 per cent. cyllin respectively for an hour: anthrax could subsequently be isolated from them with the greatest ease. The penetration into blood-stained wool of any liquid that does not kill appears to me of very doubtful service, as it may assist dissemination. I know of only one possible exception: formaldehyde has long been employed in histology as a useful fixing agent: and my observations show that when applied to blood-stained wool it acts in a similar way and makes removal of the blood more difficult. It might, therefore, be worth while to consider the advisability of adding this substance to the tanks in which bales of Van-mohair and Persian locks have to be steeped, according to the Home Office regulations, before they are opened.

It seems to me imperative that where sorting is permissible, *i.e.*, in the case of all wool and hair, with the exception of Van-mohair and Persian locks, it should be done prior to washing, and that all blood-stained material should be carefully sought for and removed.

Before the sorted wool reaches the carding-room it has to pass through two processes, washing and willowing, the latter process cleansing the wool of the heavier particles of dust and dirt, and opening up the staples. Now the question is, should the wool be washed before being willowed, or should the willowing precede the washing? Opinions are still divided. They who defend the plan of willowing before washing, say that by thus freeing the wool from an excess of dust the washbowls get charged with less mud, and that thereby the wool can be more thoroughly washed. The opposite party simply assert that the result is illusory. My own belief is that the former are in the right: my impression is that the

atmosphere of the carding-room is actually freer from dust. And in support may be cited the experience of two firms who willow before washing; one of them has had to report only three cases of anthrax in twenty years; the other has had no case since adopting this method a year ago, whereas previously not a year passed in which several cases did not occur.

Horsehair: How far these remarks may be applicable to horsehair, I am not in a position to say. Blood is certainly found, at times, on horsehair, but whether the hair is so thickly matted by it as wool sometimes is, is outside my experience. The Home Office has recently permitted an alternative method to steam-disinfection, provided a certificate be obtained to the effect that the disinfectant and the method of its employment ensure the killing of all anthrax in all horsehair. My experience suggests caution; simple test-tube experiments are insufficient: and my experiments with bundles of horsehair have so far not been very satisfactory. It is with great regret that I have seen a certificate to the above effect granted by a notable bacteriologist on apparently no better grounds than that mice and guinea-pigs injected with washings from a few grammes of horsehair which had been previously treated with cyllin *and rinsed* to free it of the disinfectant, had not died of malignant œdema, whereas most of those which had been injected with control material from another bundle of horsehair, not rinsed, had succumbed. Simply steeping in cyllin may be efficacious, but I submit that the test is insufficient.

I would, then, sum up as follows:

i. *All* cases of anthrax should be notified.

ii. The dangerous elements in wool and hair are blood-stained fleeces, locks, etc.

iii. The operative must be taught to recognise the appearance of dried blood upon the variously coloured raw material.

iv. In the absence of a reliable method of disinfection, sorting prior to washing should, when permissible, be the method by choice, to ensure the exclusion of tainted material from the washbowl.

v. In cases where steeping prior to opening is insisted upon, in the Government Regulations, the addition of formaldehyde would seem advisable.

vi. To what extent the conditions obtaining in the horse-hair industry are comparable to those in the wool industry I do not know; perhaps some of the members here present may be able to supply me with the desired information.

Dr. F. J. H. Coutts (Blackpool) said he wished to emphasize the opinion expressed by Dr. Eurich that there was a considerable leakage as regards the notification of anthrax, both in man and cattle.

In the Blackpool district a considerable number of cases had been recognised during the last few years which would probably have been overlooked had not special enquiries been instituted and bacteriological examinations made.

On one farm in the district three cows in succession died suddenly, and the carcases of two were sent for food to a neighbouring town. In the third case information was received that the carcase was coming to Blackpool, and it was therefore examined and anthrax found. Two butchers engaged in dressing those carcases contracted malignant pustule; one died, and the other recovered after excision of the pustule.

Two cases of malignant pustule in man, due to handling of hides, have been treated in the Blackpool Hospital during the last seven years; both were visitors to the town, and the disease had probably been in existence for several days before being seen. In cattle, anthrax may assume a more chronic form than usual, and may be somewhat slow in developing. Two animals, slaughtered in the Blackpool abattoirs during the past few years, neither of which showed any marked signs of anthrax, were found to contain the typical bacillus on bacteriological examination of the organs.

Dr. J. Knight (Scarborough) said his experience of anthrax was limited to a few small outbreaks in Glasgow, in connection with horse-hair. In those cases there did not appear to be any evidence of blood-staining of the hair, and the cases were all of the malignant pustule type. Apparently tail-hair was more dangerous than mane-hair.

Dr. E. W. Rees Jones (Lincoln) said the practical aspect of the subject had been kept well to the front in Dr. Eurich's paper, and the five remarks with which he finished were valuable to those medical officers in whose districts there were industries which tend to spread anthrax. The only case of that disease in the human being which had come to the notice of the Lincoln sanitary authority during recent years was that of a servant girl who died suddenly in St. Bartholomew's Hospital. The body was brought to Lincoln for burial, and careful and minute enquiries were made into the case but no trace of any possible infecting agent could be detected. There was no illness in the house where the girl had lived, nor had any of her acquaintances any connection with hide and skin works, or with the slaughtering and knackery business. From the newspaper accounts of the inquest it was gathered that the patient had been ill for two days with a cold, and was very ill. She was admitted in an unconscious condition into hospital and died almost immediately. The spleen appeared to be enlarged, and a bacteriological examination of the blood from that organ revealed the presence

of anthrax bacilli. There were no abrasions or boils about the body. The theory of the inhalation of anthrax germs was hardly feasible in that case, but Dr. Legge of the Home Office suggested that it was a case of infection through an abrasion in the tongue, and caused by eating diseased meat. If that were so it would make them very careful what they eat when their tongues were at all sore (*e.g.*, after excessive smoking), and it also reflected grave discredit upon a system of inspection which could allow such meat to pass into consumption. It was agreed upon all hands that meat inspection in rural districts was a farce.

Perhaps Dr. Eurich in his reply would suggest any further clues which might be followed up in seeking the origin in similar cases.

Dr. F. W. Eurich (Bradford), in reply, said he fully agreed with the chairman that all cases of anthrax, whatever their source, should be notifiable. There was, he felt convinced, a not inconsiderable leakage, many cases in animals and man being unrecognised. As for the recent obscure case of anthrax that formed the subject of a coroner's inquest in London, referred to by Dr. Rees Jones, one must not forget the possibility of infection being carried by insects. Furthermore, it was possible for a malignant pustule to subside, leaving only an indurated node, and yet the patient may die of general anthrax, becoming infected with the discharge dried upon his linen, or by means of his fingers or fingernails. As for blood on horsehair, he was convinced that though it had at present escaped notice it would be found if searched for, just as it had been in the case of wool and mohair.

Lieut.-Col. A. M. Davies also took part in the discussion.

THE PUBLIC HEALTH AND THE POOR LAW MEDICAL SERVICES.

By A. D. EDWARDS, M.B., B.S.Lond., B.Sc., D.P.H., L.R.C.P.,

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SO great an influence is poverty on the health, not only of the individual, but also of the nation, that considerable attention is being given nowadays to the question of the further co-operation of the Poor Law Medical and the Public Health services. Disease is most prevalent among the very poor, the conditions of their life are such that infectious diseases are more transmissible among them, and the fact that the medical attendance on these classes is in no way officially connected with the public health service is surely not to the best interests of the community. Voluntary co-operation there has been in the past, but to a limited extent only, and it has been the result of a desire on the part of a few energetic Poor Law medical officers to help in the general limitation of disease; but in order that real progress may be made, it is desirable that the medical officer of health should have a more intimate knowledge and a fuller control of that part of the population whose homes so often form the lurking place of disease. The advantages of the full co-operation or even fusion of the services are obvious in the case of infectious disease, but there are many other sides of Poor Law medical work into which it would be well to introduce more complete public health methods, with a view not only to safeguarding the public health, but also to the reduction of the cost of Poor Law medical relief, and I propose to refer to a few questions in Poor Law work which have a direct bearing on public health.

As a means of transmitting disease, the tramp is a serious menace to the general health. Dirty in person, and unclean in habits, he bears a deservedly evil reputation, and although his periodical visits to the casual ward are marked by the ceremony of the bath, it is desirable that more effective control be obtained over his class. As an instance of the present unsatisfactory state of casual ward administration, the lack of treatment of venereal disease in tramps may be mentioned. Among this class, there is a surprisingly large number of men suffering from venereal trouble in a

contagious stage, and their mode of life prevents their obtaining the prolonged treatment which is necessary for the cure or the alleviation of the condition. No Board of Guardians encourages the admission into the workhouse of such patients, and under the present system of casual administration this is to be expected, for to any union where venereally-affected tramps were readily admitted there would flock tramps from all over the country. The result is that these men are free to wander about the country in a condition which is dangerous to the health of the community, and there is here a clear indication of the need of the effective control of the class by public health methods, and the co-operation of the authorities in neighbouring unions.

Another matter which demands the keen application of public health methods is the treatment and prevention of phthisis among the very poor. Very many of the poorer consumptives are allowed to remain at home until an advanced stage of the disease is reached, and the admission into the workhouse infirmary occurs at a time when nothing can be done for the sufferer but to give him all possible ease and comfort until the inevitable end. What this means is not difficult to realise if we bear in mind the scant accommodation in the homes of the very poor. The family lives often in two rooms, sometimes in only one, and the patient remains at home, a focus of infection to the rest of the family; the children spend much of their time and sometimes sleep in the same room as the patient; and the environment, and the insufficient nourishment of the poverty-stricken child, make a combination of circumstances which is most favourable for the development of tuberculosis.

But even in the workhouse infirmaries there is too often a total disregard for the principles of isolation. There are very many such institutions where ordinary patients suffering from such things as accidents or minor chest trouble are put into a ward containing patients half of whom are advanced consumptives, and even under the moderate degree of contagion which is now claimed for phthisis, there is in the arrangement a grave risk of infection.

I believe that under full public health supervision these evils can be done away with. The greater use of the microscope would result in the early diagnosis of the cases, with a greater possibility of curing them by sanatorium treatment; and compulsory notification would result in the disinfection of the houses which are now so often the starting place of other cases of phthisis.

The non-isolation of consumptives in the workhouse infirmaries calls for early changes. The overcrowded state of the great majority of these institutions is a serious obstacle to reform, and the cost of constructing

and maintaining a sanatorium for a comparatively small number of patients has led in some cases to the combination of two or more unions for the purpose of treating their consumptives; but it is probable that under the public health supervision referred to, it will be found that even in a small union, it is worth while building an open-air institution in the country. There are two reasons for the probability, firstly, under the new system there will be earlier diagnosis and control of the cases, and therefore a greater chance of cure, so that the authorities would find it pay them to give these early cases the needed sanatorium treatment. It will cost them less to treat an early case in this way, to cure the patient and make a wage-earner of him again, than to maintain him during the prolonged course of the disease, and his family after his death. The German insurance companies have found it cheaper to treat in this way those of their clients who develop phthisis, so that apart from the humanitarian principle involved, there is a decided economic advantage.

The other reason is that a portion of such an open-air institution, with a corresponding part of the grounds, could be utilized for the treatment of a class of Poor Law children to whom very little attention has been given in the past. I refer to those children who, although they are not acutely ill and do not require constant medical attention in the workhouse infirmary, are yet not strong enough to be sent to the cottage homes or to Canada with the other healthy Poor Law children. There are at present thousands of such children growing up in the unhealthy environment of infirmary wards in the workhouses. Apart from the grave disadvantages of such a system to the mental and moral development of the child, there is a serious handicap to its healthy growth. These children grow up to become weakly, unhealthy adults, and a very large proportion of them remain on the rates all their lives. Their up-bringing in the healthy environment of the country, and with good wholesome food, would result in a much larger proportion of them becoming healthy, self-supporting adults than is possible under the present system of retention in a workhouse.

These few instances are given merely as indications of many cases in which the Poor Law medical administration would benefit by the introduction of progressive public health methods, and I believe that the combination or fusion of the two services would facilitate the working and increase greatly the efficiency of both departments.

Dr. H. Meredith Richards (Croydon) said he would like to refer to the medical treatment in the houses of the poor. No one with experience of large towns would deny that the medical attendance of the poor was unsatisfactory.

It was unsatisfactory to the community because, under present conditions, medical advice was not obtained for those slight cases of communicable disease which had so much to do with the spread of epidemics. It was unsatisfactory to the poor because they had not such attention as they needed, with the result that illness was prolonged and cures less frequent than they should be.

Lastly, it was still more unsatisfactory to the self-respecting medical practitioner who, under present economic conditions, had to undertake more work and pay a larger number of visits than he could properly attend to. That was the fault of the system under which he worked. Those who advocated reform, so far from opposing the interests of the general practitioner, wished to see him embraced in a public medical service.

Dr. C. Sanders (West Ham) said the author had chiefly referred to the institutional treatment of the poorer inhabitants, and said, if the work of the poor-law authorities and the sanitary authorities were combined, such institutional treatment would necessarily be largely increased, and it was advisable to take into consideration the present cost of such institutions, and endeavour, if possible, to reduce to a minimum their constructive expense.

Hitherto the provisions of the poor-law institutions had been compulsory, while those of the sanitary authority had been very largely optional, so that while the latter, having to treat only a few diseases, had generally been more or less expensive buildings, the former, having to cater for all or any illness arising, had been limited in constructive decoration, and were in the main proportionately cheaper.

He agreed that the poor-law medical service not only should but must ultimately be handed over to the sanitary authority, but felt that it would be wise for medical officers of health while doing all in their power to advance the union of the two services, at the same time to urge a greater economy in non-essentials.

Alderman R. Flowers (Newcastle) said he believed in the local authority having control over the administration of both the poor law and all local matters. In his opinion, it would be cheaper. The ratepayers were the persons who had to pay all rates, whether local or otherwise. In regard to consumptive cases, he thought it would be better to send patients into the country to sanatoria there, rather than to isolated wards in the workhouse.

Dr. E. W. Rees Jones (Lincoln) said one point to be borne in mind in discussing the union of those two services was the fact that in many cases the sanitary and poor law areas were not co-terminous, therefore there was some fallacy in stating that it was a matter of indifference whether the poor-rate or district-rate paid any given bill.

While the fusion of those two services was probably somewhat remote, there was one subject which ought to be transferred to the sanitary authority, *e.g.*,

vaccination. It was somewhat of an anomaly that that subject was in the hands of an authority which had nothing to do with the health of the public, but rather with the keeping down of the poor-rate.

Mrs. Sidney Webb's paper on the relation of the two authorities, read to the Society of Medical Officers of Health, and printed in the journal of that Society, was well worth re-perusal.

In many towns the question of payment for the treatment of sick poor in hospitals, when suffering from infectious disease, was frequently a source of misunderstanding between the two authorities. One side said it was the duty of the guardians of the poor to provide medical treatment for their cases, and therefore they should pay for their maintenance in the fever hospital, while the other side said that their treatment in hospital was done in the interests of the public, and therefore the expenses should be borne out of the rate levied for sanitary purposes.

One speaker had advocated, on the score of economy, the erection of temporary buildings, but the Lincoln Sanitary Authority had recently found that form of building not economical. A temporary corrugated iron building, lined with matchboard, and used for the isolation of diphtheria, was recently completely destroyed by fire. £500 was received from the Insurance Company for damage done, but it would require nearly £2,000 to replace it by a non-inflammable building.

Miss Eva H. Jones (Bradford) said that paper appealed very strongly to a public health official, there being often friction between the sanitary authority and the poor law authority, the former being concerned chiefly in saving lives, and the latter apparently in saving rates.

So many infants died from atrophy and debility, due often to the expectant mother having obtained no relief, or insufficient relief, during stressful times. Fluctuating trade threw many men out of work, and the mother was usually the first sufferer, denying herself for the sake of her family, the relief, *when* provided, being often of the barest description.

Dr. A. D. Edwards (Bournemouth), in reply, referred to the cost of the change of administration. He believed that there would be such a marked saving of money by the introduction of public health methods that it would compensate for the initial expense. The rearing of the poor-law children under hygienic conditions would result in a larger proportion of wage-earning adults.

The work done by the poor-law medical officers was unsatisfactory, but it was unsatisfactory, not because of the medical man, but because of the system.

The sanatorium treatment of phthisis was valuable for educational use, and as a means of removing the patient from the home where he would be a focus of infection.

CRECHES AND SANITARY ADMINISTRATION.

By D. J. THOMAS, D.P.H.

I HOPE that, in choosing this subject, I shall not be accused of losing all sense of perspective. I know that in most of the industrial centres of South Wales, creches are unnecessary; married female labour is not an important factor in the causation of infantile mortality; at any rate that is true of the mining districts of South Wales. To what extent this factor operates in some districts, may be judged from the following figures:—

In Acton, at the Census of 1901, there were 2,448 women employed in the laundry industry alone. The number has increased considerably since, and now there are 93 registered factory laundries, and 230 workshop laundries, in addition to the home-workers. There are over 3,500 women employed in the laundry industry alone, and of these about 1,500 are married women, or widows. We have in the district over 300 children under 12 months old, whose mothers are occupied in laundry work. These children are taken in the morning to a house where they are looked after until the mother finishes her day's work, when she calls for them on her way home. The standard of cleanliness which obtains in the home of the baby-minder is usually below that of the average of the neighbourhood. The baby-minder is generally incapacitated from work on account of ill-health or intemperance, or some cause which does not conduce to cleanliness in the house. The house is not under any direct sanitary supervision, and no argument is needed to prove that a child whose mother has to go to work is better off as regards cleanliness in a creche than in the house of a baby-minder.

It is not to the higher standard of cleanliness observed, nor to the more careful mode of feeding adopted at the creche, I wish to direct attention. These advantages are obvious and generally admitted. My object is to try and meet two of the chief objections raised to the establishment of creches, and to endeavour to show how a closer relationship between the sanitary department and the creche authorities can obviate some of the difficulties met with.

I think we are all convinced that one of the chief causes of the high infantile mortality in industrial centres is the increase of artificial feeding. The researches of Professor Bunge of Basle are known to most of you. He found that only 519 out of 1,912 mothers were capable of nursing their offspring for nine months. Inquiry into their family history showed that the daughter of a mother who could not nurse her own children is also commonly incapable of suckling. If this function is once lost in a family, it is not likely to be regained in subsequent generations.

One of the objections raised against creches is their liability to encourage premature weaning, and in many creches it must be admitted that this danger is not sufficiently appreciated. I believe this is due to the entire absence of co-operation between some sanitary departments and the creche authorities. It may be of interest to record the circumstances in which a creche was established in Acton.

In the Acton Improvement Bill of 1904, a clause was inserted giving the Council power to support the maintenance of one or more creches. The Committee of the House of Lords, though expressing sympathy with the object of the promoters, refused its sanction to the clause. It was felt by the promoters that the value of a creche would be enhanced if it could be carried on with the co-operation of the sanitary department. Fortunately, the chairman of the health committee interested himself in the matter, and when a creche was established, he became, and still is, chairman of the committee of management. The medical officer of health and the health visitors are always invited to attend the meetings of the committee. The creche, therefore, though supported by voluntary agencies, approximates somewhat to a municipal one. This association has been the means of encouraging breast-feeding in at least three ways. When the question of the site of the creche and its size was discussed, it was decided that it should not be too large, and should be so situated as to be convenient for the mothers to leave their work twice a day for the purpose of suckling their children. The creche has 28 cots, and all the mothers work at laundries within easy reach.

Secondly, every encouragement is given at the creche to the mothers to suckle their children. A glass of milk, or a cup of cocoa, and a biscuit are given to the mother free whenever she comes to suckle the child.

But convenience of situation and encouragement at the creche to suckle would often prove useless if the ground had not been already prepared by the health visitors. Before the passing of the Notification of Births Act, mothers often weaned their children during the first month. We are now able to come in contact with the mothers before the mischief of premature

weaning has been accomplished. It is very difficult to make an impression upon mothers by endeavouring to teach general principles, but when a concrete example can be given, by means of which their individual case can be met, the result is far more beneficial. When a birth is now notified inquiries are made, and if the mother is likely to go out to a laundry to work the creche is mentioned, and the mother advised to continue in the suckling of the child.

I have dealt with what can be done in this respect through the agency of creches as now constituted. If the creche were a municipal one further regulations could be made for the encouragement of breast feeding. More stringent inquiries might be made before admitting an infant who is being artificially fed, and further concessions made (in the shape of reduced charges) to mothers who suckle their own babies.

The second objection urged against the establishment of creches is based upon their liability to act as foci in the spread of infectious disease. This objection refers almost entirely to measles. Everyone admits that wherever young children congregate measles is liable to spread among those children. It is too early for me to draw any conclusions from our epidemic, but we have recently passed through one of the most extensive epidemics of measles in the history of the district, and in no instance did the disease extend amongst the children of the creche.

The system of school notification of illness provides us with a fairly accurate knowledge of the distribution of measles and the other non-notifiable infectious diseases within the district, and we are thus able to assist the matron of the creche in her attempt to exclude all contacts. The matron supplies us with a list of the children in the creche, with their addresses. Whenever a case of infectious disease is known to have occurred at any of the addresses given, all children from that house are excluded from attendance at the creche until the risk of infection has passed.

It may be urged that the size of the creche and not the sanitary co-operation has been the cause of this freedom from infectious disease. A number of small creches, of course, are less liable than one large one would be to spread infectious diseases. The smaller the creche the more intimate knowledge of the home conditions the matron is likely to have, but I claim that the danger of spreading infectious disease in a creche can be very materially reduced by such means as those mentioned.

There is one other aspect of the question which I should like to mention. I refer to the recommendations of the Inter-departmental Committee on Physical Deterioration, suggesting that girls should be made to

attend municipal creches, and that the teaching of infant management to such girls should be aided by the education grant.

There can be no doubt that the pressure of economic and social conditions in our great industrial communities is destroying the interest in house management and rearing of infants among girls and women who have to work in factories and places of business, and unless the instruction in hygiene is given early it is unlikely to be acquired in later life.

As the strenuous work of the school teachers leaves them little time and energy in which to gain acquaintance with domestic work and the rearing of young children, it may be urged that creche schools and nursing dispensaries would prove a means of gaining practical knowledge in subjects of far more value than some now existing in the school girl curriculum.

Although the age of the scholars may be considered an objection to this specialised teaching, yet a wise training in domestic hygiene can only have a good effect on the mothers of the future; and by diminishing the lamentable results of ignorance, it should be of undoubted value in the reduction of infantile mortality.

I ought to explain why the economic aspect of married female labour has been ignored. I am well aware that many persons look upon a creche as an accursed thing; it tends to foster married female labour, and married female labour is considered by them not only a physical mistake but an economic heresy. I have intentionally left the subject out, as I considered it far too wide to allow of its useful introduction into a paper of this kind. In the ideal state, probably, the mother will not be required to leave her babe to the tender mercies of others, but under present social conditions, and possibly for many years to come, married female labour will be employed, and it behoves us to adapt our administration to meet any circumstances which confront us.

Miss Erie Evans (Cardiff) said that the special interest of the paper to her lay in the indication given as to the value of the creche in furthering breast-feeding by the mother. She inquired whether any arrangement had been made whereby the mother could leave her work to nurse her child without forfeiting her wages. So long as the bearing and the rearing of children penalised the mother economically, so long would the question of infantile mortality remain acute.

Mr. William Geo. Cooper (Bournemouth) asked whether the time of one month, as prescribed by the Factory Act, could not be extended, and thus allow

for the wet nursing attention by the mother. Would not this meet the case rather than the extension of the system of creches?

Councillor D. W. Brown (Preston) said that in Preston they thought married female labour had been an important factor in the causation of infantile mortality. Left alone from its natural food, a child had to depend on the artificial means supplied by the nurse. Creches were in existence 40 to 50 years ago, in connection with some of the larger mills, but were not a success. Recently three, of a private character, were begun; two lasted less than twelve months, one for three years having also closed within the last month. The attendance of a mother from a cotton mill to feed her child periodically would not give as good result as careful artificial feeding, on account of the unhealthy state of the mother's nipples from oil, sweat, and unwashed clothing.

The institution of domestic centres for teaching cookery, laundry work, and housewifery, in the last-named subject infant feeding being prominent, was hoped to be beneficial, and all girls above eleven years of age attending the elementary day schools were compelled to attend.

Mr. John Clare (Hanley) said it was during the dinner hour, that was allowed at the factories, that the mother had the opportunity of visiting the creche and suckling the child. That was a reason why the creche should be situated where the distance from the manufactory would not be prohibitory.

Mrs. Reginald Green (Northfield) said two excellent creches were seen last autumn in Berlin, exceedingly well managed and clean, one, in a crowded part of the town, a converted dwelling house with its several bed-rooms containing only a few infants each, the risk of infection being thus lessened. Rooms were provided in this creche where the mothers might sleep at night. The other was for the reception of delicate infants; it was a small house, spotlessly clean, in the midst of pine-woods, a portion of which was enclosed as a garden, in which, on a fine day, the infants were seen, the small ones sleeping and the bigger playing about. Here the infants spent day and night until they had become strong and healthy.

The people in charge of both these "Säuglingsheime" were trained nurses.

CONGRESS AT CARDIFF.

CONFERENCE OF ENGINEERS AND SURVEYORS.

ADDRESS

By A. E. COLLINS, M.Inst.C.E.,
City Engineer, Norwich,
(MEMBER),
PRESIDENT OF THE CONFERENCE.

MY acquaintanceship with the work of County and Municipal Engineers and Surveyors extends sufficiently far back for me to remember the great opposition which used to be aroused by almost every attempt to improve the health conditions of towns or of individual houses. The opposition then encountered had as its basis lack of knowledge, prejudice, dislike to expenditure, or the sentimental objection to any interference inconsistent with the idea that every Englishman's house is his castle.

The Royal Sanitary Institute has done most valuable service to the nation by arousing interest in and making known the proper methods of living and the advantages arising from efficient sanitation, with the result that to-day it is not usually necessary in enlightened communities to be obliged to force forward works requisite for the attainment of healthful conditions such as sewerage, water supply, playgrounds and open spaces, and numerous other things contributing to our enjoyment of life.

When I joined the ranks of public officials, well over a third of a century since, the work done in municipal surveyors' offices was very limited in compass and character compared with that of the present day. Excepting as to a few specially situated towns, sewage purification was little more than talked and written about. In most towns, untreated sewage ran into the sea or nearest river: the sewers themselves were usually of most unsatisfactory construction, trouble rarely being taken to ensure water-tightness or smoothness of their interiors. Means of flushing, access, ventilation, and other necessary appliances of sewers were little

considered. It is probable that not half-a-dozen towns in the country possessed machinery for pumping sewage or felt any necessity for its possession. Apart from water supply purposes, no machinery, not even the steam roller, was used by towns, and the water works, which in some cases had machinery, were generally owned by companies. Where building by-laws existed they were frequently of a very sketchy character, leaving much scope for arguments and disputes between the surveyor and the builder.

There were thoroughly competent engineers and surveyors working for municipalities in those days, but such men were not so general, either proportionately or in actual number, as to-day, nor did the average of their work demand such high qualification and efficiency as are now required. Even to-day there is no compulsion upon local authorities to appoint only competent engineers and surveyors, and from time to time cases occur of men being placed in positions for which they have few, if any, claims on the ground of efficiency, whilst suitable candidates are passed over. Further, after a local authority has appointed a surveyor there is no certainty of fair treatment, with the result that occasionally such officers owe the loss of their appointments to enmities created by the proper discharge of their duties. Quite recently such a case came under my notice. A competent surveyor, serving a local authority, caused a highway encroachment to be abated. The landowner responsible for the encroachment was not at the time a member of the local authority, but he told the surveyor of his intention to become a member for the purpose of hunting the latter out of his berth. It took the landowner a few years to carry out this threat, but he eventually succeeded, and the surveyor has no redress. In local government areas, medical officers of health and sanitary inspectors are protected in their work, inasmuch as they can only be discharged with the consent of the Local Government Board. This is a most necessary and proper provision, the operation of which should be extended to all officials who in the carrying out of their duties are likely to incur the ill-feeling of owners or occupiers who, it must not be forgotten, often are or may become members of the authorities served.

The Town Planning Bill of the President of the Local Government Board, if it becomes law, will throw great responsibility and work upon surveyors and often bring them into direct conflict with owners and occupiers; notwithstanding this, the Bill gives no protection to these officials. A body of far-reaching influence like The Royal Sanitary Institute could render very valuable service by creating a powerful public opinion in favour of the requirements that none but competent surveyors should be appointed to carry out duties upon which the health and comfort

of the public depend, and that they should be protected in the proper carrying out of their duties after appointment.

The improper appointments which have been made and the unfair dismissals effected, have usually occurred with the smaller local authorities. Generally in the larger towns these abuses do not occur; this and other considerations lead one to conclude that probably there has been too great a sub-division of the country into independent local government areas, with the result that many authorities exist who find it financially impossible to engage the services of competent officials, hence health conditions suffer and money is wasted. The Royal Sanitary Institute would do well to utilise its influence in directing attention to this feature of local government and to the best means of improving matters.

The work required of the present day engineer and surveyor is of such highly complex character as to defy adequate description within the limits of this short address, but for the information of those present who do not hold such offices I may say it includes investigating, reporting upon, and carrying out works in any or all of the following subjects:—Street and road construction and maintenance, including all sorts of methods of paving, flagging, concreting, macadamizing, tarpaving, cleansing, watering, lighting and tree-planting; sewerage, sewage pumping machinery, sewage treatment, sewer ventilation, sewer maintenance and cleansing; water supply, pumping, filtering and distribution; administering buildings, by-laws and those relating to new streets; design and construction of isolation hospitals and lunatic asylums, with their arrangements for heating, hot-water supply, steam and other cooking, disinfection, steam and other laundries, fire appliances, telephones, etc., etc., etc.; erection of public offices, free libraries, museums, picture galleries, and care of corporation estates including houses thereon; laying out of public parks, gardens and pleasure grounds, including athletic appliances, preparations for games such as cricket, football, bowls, lawn tennis; provision of swimming and other baths and their heating and water supply; street tramways; refuse destructors; abattoirs; river improvements; bridges. Further, when any work of an unusual character arises it is generally referred to the engineer and surveyor.

It goes without saying that no man living can be an expert in so many varieties of work, and it is astonishing that the general average quality of the multifarious works carried out by surveyors is so high as it is. With so much to do, a surveyor has little time for independent investigations, and for most departures must rely on others; in this he can and does obtain valuable help. The marked advance made in investigation

work is apparent. Consider, for instance, the treatment of sewage. A third of a century since the towns attempting to treat their sewage could be counted on the fingers, and the work was done almost entirely in ignorance of the actual cycle of operations. For many years there was no apparent progress in the understanding of the problem, and it is only comparatively recently that the work of such men as Santo Crimp, Scott Moncrieff, Col. Jones, Dibdin, and Travis, culminating in the Hampton investigations, has shown the necessity for, and the means of, removing nearly all solids from sewage before filtration or irrigation.

In these days an engineer and surveyor can only keep abreast of the times and advise the Authority he serves to the best advantage, by constant watchfulness of progress: and the Congress affords one of the best opportunities of comparing and exchanging experiences and of feeling the pulse of progress.

I have obtained a great deal of such knowledge as I possess of public work as a result of attending conferences like the present, and as one of the older engineers and surveyors of the country, I feel that local authorities would be well advised in requiring their surveyors to attend them.

Local Authorities, subject to the audit of the Local Government Board, cannot however incur any expense in this connection. This I consider to be a defect requiring correction.

My advice applies as much to the older as the younger men: the former to give of their experience and to be refreshed in their work by contact with the enthusiasms of their younger brethren, and these in their turn to learn from the successes and failures of their elders, and with this knowledge make further advances toward perfection for the good of all.

THE BEST METHOD OF MIXING AND LAYING TAR MACADAM FOR STREET AND MAIN ROADS.

By JOHN S. BRODIE, M.Inst.C.E.,
Borough Surveyor, Blackpool.
(FELLOW.)

WHAT are the essential ends to be aimed at in all rational road-making? They may be briefly summarised as:—(1) Freedom from dust in summer and from mud in winter; (2) Freedom from the noise and clatter at present inseparable from many of our urban streets and main roads; (3) To be of an inclination, width, and cross-section suitable for the high-speed traffic of the future.

Now, until the evolution of an ideal road surface material (which the author by no means despairs of), tar macadam is, with certain limitations to be presently referred to, one of the few materials at present in use which most nearly fulfils the above requirements.

Foundation.

The first essential condition for a successful tar macadam road is a dry and strong foundation.

The author's practice is to under-drain where necessary the site of the proposed tar macadam road (whether a new road or for replacing old pavement on an existing road) with open-jointed 3-inch tile-drains, connected to the surface water gullies. Where a road is on sandy or light porous sub-soil, with sufficient natural drainage, under-drainage is, of course, unnecessary.

The under-bed is then formed to proper levels and contour, by means of a transverse sectional gauge, and is thoroughly rolled and consolidated under a steam roller, any inequalities being made up with sand-filling.

On the under-bed prepared as above, the foundation proper is then laid. It consists of rubble (grit, limestone, granite, or even good hard clinker, as may be most economical) 9 to 12 inches in length, 3 to 6 inches in width, and 7 to 9 inches in depth, laid on edge lengthwise across the road. The interstices are filled up with similar stone broken to $2\frac{1}{2}$ to

$3\frac{1}{2}$ inches gauge, and the whole foundation is rolled, by a ten-ton steam road roller, to the correct cross sectional gauge or template above referred to, until the surface of the foundation presents the appearance of a well-rolled macadam road. On the foundation, prepared as stated above, the tar macadam, when mixed, is laid.

TAR MACADAM SURFACE.

The materials forming tar macadam are (*a*) suitable hard stone or slag to resist the wearing action of the traffic, and (*b*) a matrix impervious to moisture and sufficiently elastic and tough to bind the harder material together. The author has used extensively granite, blast furnace slag, and many varieties of limestone, as traffic-resisting materials, and has found most uniform satisfaction to follow from the use of a suitable grey or light-coloured limestone.

Granite, chiefly owing to its non-porous nature, is a somewhat uncertain material to use, although good results have been obtained from its use in certain instances.

Slag is open to objection chiefly because of the impossibility of procuring a uniform quality, however carefully the selection may be made. So many elements of uncertainty arise from the use of the different kinds of iron ore smelted, the nature of the limestone used as flux and of the coke as fuel, that the slag is left to come out as it may, since its quality is no concern of the iron smelter, and is merely a haphazard result. The proof of this is seen in the uneven way in which tar asphalte made of slag usually wears.

The stone, having been selected, must be broken to three sizes, $2\frac{1}{4}$, $1\frac{1}{4}$, and $\frac{3}{8}$ to $\frac{1}{2}$ inch, and all dust, dirt, and smaller material most carefully screened out of it.

The matrix used by the author consists of suitable hard pitch properly tempered by impure carbolic acid, or dead oil, commonly known in the trade as creosote oil. Both of these substances are derived from the distillation of coal-tar, itself a most complex substance, and hence the necessity for chemical tests of both pitch and oil in order to make sure that the light oils (benzolene, napthalene, etc.) have been properly removed in the process of distillation.

MIXING.

These materials are mixed in the proportion of about one gallon of oil to forty pounds of pitch, but this proportion may often require modifying, as the pitch and the oil vary in quality, and the mixture should be tested

when boiling by samples being taken out of the boiler and cooled to a temperature of about 60° F., and tested for elongation of about 30 inches, and for bending double without fracture.

The stones having been properly dried, so as to expel all the moisture, but not to injure the stone, the various sizes of stone are then separately covered with the asphalte composition while boiling hot, to which a small quantity of dry sand and lime is added in the buckets after it leaves the boiler, and stirred up by hand. There are several mechanical mixers now being used, but the author prefers hand-mixing on hot plates, so as to guarantee that while the entire surface of every stone is coated with the composition, there is not an excessive amount of the liquid, resulting in what is known among the workmen as making the asphalte too fat.

The asphalte having been mixed as above, is stored in separate heaps of various gauges, under cover, ready for use, but is distinctly improved by remaining in store exposed to the air, but protected from the rain, for a few days before it is laid in position.

Laying.

The asphalte macadam should be laid on the foundation prepared as above described, in favourable atmospheric conditions. No asphalte macadam should be laid when rain is falling, nor immediately after rain has fallen, nor until the surface of the foundation is reasonably dry.

The prepared material should be spread in successive layers, that of the largest gauge in the bottom, that of $1\frac{1}{4}$ inch gauge next, and that of the finest gauge on the top.

An allowance should be made of from twenty to twenty-five per cent. more depth than the ultimate depth aimed at after rolling. Thus, for a finished depth of five inches of tar macadam, at least six inches in depth should be spread. The thickness of the intermediate and top layers should not vary whatever the thickness aimed at, the variation should be all in the bottom layer of large-gauge stones.

All the layers having been put on, rolling with a steam road roller of from ten to fifteen tons, on a wheel-base of six feet, should be started at once, before the material has received any moisture or dust. The roller wheels should be properly cleaned before they are allowed on to the asphalte. The rolling should be continued until the rollers have passed at least twenty times over the entire surface of the road.

No traffic should be allowed on the road until at least forty-eight hours have elapsed after rolling is completed, so as to give the tar-macadam sufficient time to harden.

LIMITATIONS OF TAR MACADAM ROADS.

The use of tar macadam for forming the surface of roads and streets must be confined within certain limitations, as follows:—

1. Not suitable for gradients steeper than one in twenty-four (half-an-inch in a foot), by reason of its slipperiness after wearing smooth.

2. Not suitable for heavy traffic. In any road, whether a street or main road, where the traffic exceeds an average of more than one hundred tons per yard of width of roadway per diem, tar macadam will be found to be more expensive to maintain than wood-paving, or even rock-asphalte.

3. On the other hand, for purely residential streets, whether front or back, where local traffic only, or a thorough traffic limited in amount to the extent indicated above, is expected, a tar macadam road surface will give unqualified satisfaction as being (*a*) impervious to moisture, and therefore always clean and free from dust and slops; (*b*) practically noiseless; (*c*) the most economical roadway known, considering its advantages.

MR. R. READ (Gloucester) was glad that the author laid stress on the foundation, as that was the real road. There was an idea amongst the general public that tar macadam was a kind of universal panacea for bad roads. But there were no actual wearing properties in the tar, it only served to waterproof the road and prevented the rain from soaking in, rotting and destroying it by producing mud and consequently dust. To economise tar he had used small tar toppings to an ordinary coat of stone, working the tarred small stone into the joints of the larger stone after once rolling. This cemented the stone into a mass economically, but of course it did not make so good a job as when the whole coating of stone was tarred before laying.

MR. THOMAS READER SMITH (Kettering) said with reference to materials he would like to hear the experience of others as to granite, but he thought that if more pitch were put in the tar when those materials were used it would produce good results. Slag, as the author stated, was a variable material, but in some places was practically the only material available. It was not so much a bye product as it used to be, and at some furnaces great care was taken to produce a reliable material. Experience would show from which furnaces the better slag could be obtained, and its general quality could be relied on; it could also be supplied fresh from furnaces in sheeted wagons, avoiding the expense of drying on stoves.

As to the various gauges, the thicknesses of the different layers were not given, but he thought it a mistake to finish with a fine topping, especially on any appreciable gradient, as the surface became very slippery. A topping of $1\frac{1}{2}$ inch stone, 3 inches thick, with smaller material, gave a good surface for foothold, but had the disadvantage that not being perfectly close, as it wore

down it began to break up sooner than a finer material which would roll more solidly together, and he found the best all round results to be given by slag broken to 1 inch gauge and containing smaller sizes, which made a good solid coating, the only fine material used for topping being untarred chippings about $\frac{3}{8}$ to $\frac{1}{2}$ inch gauge sprinkled on to close the interstices and form a close surface.

The author used creosote oil and pitch, and was able to check the quality by the aid of a chemist. In smaller towns authorities did not employ chemists, and surveyors had to rely on practical tests and observation, and on skilled workmen. It was most important in using tar that all light oils and water should be expelled by sufficient boiling before mixing.

As to rolling, he thought a 10 ton roller sufficient, and a lighter roller, say 6 tons, would frequently be better. He frequently finished the surface in hot weather by a prolonged rolling with a half ton water ballast roller, keeping the traffic off as long as possible.

Mr. R. W. Cass (Farnham) asked whether, having regard to the additional cost in using tar macadam on roads, over that of ordinary waterset surfaces treated with a surface dressing of tar, oil, and pitch, the author considered that the use of tar macadam gave sufficient additional benefit to warrant its use.

Having maintained different sections of the same road for a period of three years under the following conditions, he found the cost results came out as follows (the cost was given at per square yard per annum on each section):—

A.—Waterset ordinary surface outside town ..	5·5 pence.
B.—Waterset surface, treated with tar, oil, etc.	4·2 pence.
C.—Coated with $4\frac{1}{2}$ ins. of tarmac, 3 ins. of $2\frac{1}{2}$″ gauge, 1 in. of $1\frac{1}{2}$″ gauge, $\frac{1}{2}$ in. fine topping, rolled with 10-ton steam roller ..	12·0 pence.

As regarded efficiency, B gave the best results over the whole period, and the tar macadam lasted no longer than the waterset surfaces treated with tar, etc., but longer, of course, than the ordinary untreated waterset surface.

As regarded chemical tests for tar before using, he did not think them necessary, as in the heating of the tar the light oils came off at known temperatures: it was a good thing for the purpose of preparing tar for use on roads that the light oils should be got rid of, and that a heavy oil and pitch should be added with a little lime and resin, which mixture, properly applied to good waterset surfaces, would secure all the advantages to be claimed for tar macadam, a section of which was far more liable to fail from a variety of causes difficult to avoid, than a good waterset surface properly treated as above suggested.

Mr. G. William Lacey (Oswestry) said further information was needed with reference to the use of granite for tar macadam. It seemed to him if the tar was of the proper quality and consistency the adhesion of the aggregate should be secured. He had had experience both with slag and limestone, and he was bound to say that although it could not be recommended for heavy traffic, the

latter gave a better foothold than the former, and formed a very good material. He agreed that the foundation was an important feature. If you had soft places or depressions hollows were formed, which, holding water, certainly tended to cause the macadam to perish. He had proved the value of tar macadam as against water-bound metalling. It was more economical in the long run, to say nothing of the comparative freedom from dust and mud, and he was about to lay down a considerable area of tarred granite macadam. He thought that a roller of ten tons in weight was ample, if not too much.

Dr. S. Rideal (London) said the removal of water and light oils from tar could be easily ascertained by means of a glue-pot and piece of looking-glass. A properly boiled oil when heated in the glue-pot would not dim the cold mirror when held over it.

Mr. A. E. Nichols (Folkestone) said that for light traffic (seaside town work) a very satisfactory tar road, he found, could be made from refuse clinker formed into tar-macadam with a surface of tar toppings, made from rag stone, granite chippings, or other suitable material, spread very thinly over the clinker bottoming for actual wearing purposes. This gave a clean and quiet road, which would go for years without appreciable wear.

Where a road of this description (which cost about 3s. per super yard) was too expensive, he had tried another method with success. An ordinary macadam road was scarified and the surface, screened of the finest dust, replaced and rolled down dry: after this thorough rolling, hot tar was swilled over the surface, percolating probably three or four inches down, and when the tar had somewhat settled, the surface was dusted over with the dust originally screened from the material.

The author laid stress upon the various layers of tar macadam being put on before receiving any moisture (he took it he meant in dry weather) necessary for the work. After the tar macadam foundation had been laid he had never found any ill effect due to subsequent layers having been put on in wet weather. This remark did not apply to the tar-painting of the surface of the roadway, where one could not be too careful about selecting a dry day for the treatment.

Mr. John S. Brodie (Blackpool) said, in reply, he would like to impress on his brother surveyors that the methods of those good old surveyors, Telford and Macadam, were sufficient for their day, but would not serve at the present time. They must rise to the occasion and construct roads suitable for the new traffic which they had now to carry, otherwise it would be said that they were unequal to their opportunities, and were unworthy of being called the successors of road engineers such as he had mentioned.

Councillor T. Ramsey also took part in the discussion.

UTILISATION OF RESIDUALS FROM REFUSE DESTRUCTORS.

By H. PERCY BOULNOIS, M.Inst.C.E.

(FELLOW.)

THE object of the so-called destruction of refuse is to reduce the bulk of the refuse by burning, and this process converts it into steam and gases, which pass through the flues and up the chimney shaft to be dissipated in the air, leaving behind in the furnaces a mass of clinker, and in the flues and the base of the chimney a certain amount of fine ash or dust. Roughly speaking, the amount of clinker thus left is from 25 to 33 per cent. of the refuse treated, and of the fine ash about 1 per cent.

The amount of refuse produced in a town in this country is about a quarter of a ton per head of population per annum, so that for 40,000 inhabitants, if all the refuse were burnt, there would be about 2,500 tons of clinker and 400 tons of fine ash to be dealt with as residuals every year. The gases are also residuals, as they contain heat which should be utilised. There are other matters, such as tins, whole bottles, etc., which are not put into the destructor, and may fairly be described as residuals.

Dealing first with the CLINKER, the composition varies somewhat with the nature of the refuse, but generally speaking it may said to be:—

Silica	69·4	per cent.
Iron and alumina oxides	21·4	„
Carbonate of lime ...	9·2	„

The fine ash is of much the same composition but generally contains more silica.

The uses that have so far been discovered for clinker are as follows:—(*a*) Filling up pits, or raising the level of lands for various purposes; (*b*) bottoming roads of light traffic; (*c*) breaking up in a crusher and forming mortar with lime in a pug-mill; (*d*) mixing the broken clinker with Portland cement to form concrete, either *in situ* or to form flags, kerbs, paving, and many other purposes, even, as in Liverpool, to construct the walls of houses in large sections; (*e*) making bricks; (*f*) using

the finely crushed clinker in place of sand for the cushion bed of street paving, for grouting, or even for "sanding" a slippery surface; it can also be used for plaster or other purposes where sand is employed; (*g*) using the broken clinker in the construction of bacterial filters or contact beds in sewage disposal works.

With regard to (*c*), the breaking of destructor clinker is not so easy as would appear, on account of iron and other hard substances which pass through the fires. The crushing mill must be so constructed that it will withstand shocks; a good one in this respect is that of Messrs. Cox and McTaggart, of Bradford, consisting of a pair of fluted rollers cast on to a chilled face geared together and driven by a helical spur wheel; the rollers have a special elastic attachment to the spindles to minimise shock. The gauge to which the clinker is broken is regulated by rotating screens. So with the mortar mill. Owing to the extreme hardness of the material the rollers should be of double the weight usually employed; and the side frames, cross beams, and pan of greater strength. Messrs. Horsfall, of Leeds, make a very suitable mortar mill for this purpose.

With reference to (*d*); the manufacture of flags in moulds, either with or without pressure, has been successfully carried out for some years. The crushed clinker is mixed with Portland cement in about the proportions 75 parts clinker to 25 parts Portland cement, and, if pressed, about 60 tons per square foot should be allowed. Flags thus made are easily handled, and "ripen" more speedily than those not made under pressure.

There are many adaptations of this process: kerbs, landings, steps, cills, and even overmantels and architectural details, which have the appearance of stone, can be constructed. In Liverpool, whole sides, floors, and roofs of buildings have been constructed in moulds, with clinker and cement, and buildings for the labouring classes erected therewith at surprisingly low cost.

With regard to (*e*) making bricks. At Zurich, in Switzerland, Dr. Schultess, the head of a large firm, has successfully introduced a plant for the purpose. I understand that the Schultess plant consists of a lime-making machine in which the slaking is effected by means of a small quantity of moisture and by the aid of low pressure steam: all excess of water in slaking is thus avoided and hydrated lime is obtained in a fine powder: this is then carefully screened to exclude any foreign matter and passed to the measuring machine where the proportions of lime and clinker are mixed, thence to the mixing machine where the proper quantity of water is added. The moulding is effected in a press of considerable

power. The bricks are then put into a steaming chamber, where they are subjected to saturated steam at atmospheric pressure for about 48 hours, after which they are said to be ready for use.

At Fulham there is a brick making plant, erected by Mr. Wood, the surveyor, where crushed clinker 9 parts and 1 part of cement are made into bricks with a special pressing plant capable of turning out 3,000 bricks a day at an inclusive cost of about 20s. per 1,000. The materials are mixed in the ordinary way and a brick is produced weighing about 6 lbs. with an absorption of water of only 6 per cent., and which can stand a test (Kirkcaldy's certificate) of 216 tons per sq. ft. when five weeks old, and of 280 tons when 13 weeks old. The bricks do not command a very ready sale, as they are very hard to break, and the bricklayers find them rather harsh to handle and impossible to break with the usual blow from the trowel. These bricks are, however, equal to the Blue Staffordshire brick and are of a pleasing grey colour, and such a use for clinker should be encouraged and developed.

The Sanitary Block and Tile Paving Company have made paving blocks which, I understand, have been successfully laid in London and elsewhere; these blocks are made of clinker and Trinidad Lake asphalte, and a plant capable of turning out 5,000 blocks a day can be installed for about £3,000. The cost of this description of paving is said to be from 2s. 6d. to 3s. a square yard.

With regard to (*f*), the use of finely crushed clinker as sand, there can be no doubt that a greater use of this material might be made for building purposes generally were it not for a certain amount of prejudice; but where the clinker has been subjected to fierce heats which is now the case in all properly constructed destructors, there cannot be the slightest objection on sanitary grounds to the use of this material for all purposes where sand can be used.

With regard to (*g*) the use of clinker for the construction of bacterial filters or contact beds for the purification of sewage, this has been tried at a great number of places with, generally speaking, good results.

Mr. A. C. Bothams, of Salisbury, has very kindly given me some particulars of the use of this clinker on some percolating filters where he tried it in comparison with gas works clinker: he says he prefers the refuse destructor clinker as being rougher in shape, this giving more surface in the same bulk. He found, however, that the summer refuse produced a rather "rotten" clinker, not of much use for anything, and that he could only use the harder clinker made in the winter. The filters have been in

use since 1903, and the analysis of the effluents showed a remarkably good result.

It is evident that with properly well burnt hard clinker the utilisation of this waste product for such a purpose is of value where a better material cannot be procured at a reasonable cost.

I think this completes the uses that can be made of destructor clinker so far as I have been able to ascertain them, but possibly there may be still a more extended field for its use.

Dealing with the *flue dust*, or fine ash, there appear to be only two uses for this, (*a*) making it into a disinfecting powder by mixing it with a disinfectant; and (*b*) using it as a fertiliser for grass or for lightening heavy clay soils. With regard to (*a*) I have been able to ascertain very little; I do not see that any disinfecting powder can be improved with this addition, but it may render some disinfectants more portable and easy of manipulation. I understand that it is sometimes used in connection with the disinfection of pails used in the interception systems. With regard to (*b*), I believe that it has been used under certain circumstances with great success, and no doubt the application of such a material to grass lawns improves them, and the same may be said for lightening heavy clay soils. When mixed with various fertilising ingredients it makes a good portable manure.

The next point to consider is that of dealing with the tin cans, buckets, empty meat tins and different kinds of metal which are always found in more or less quantity in home refuse. There is a market for these residuals, but hitherto, owing to their bulk, they have been difficult and costly to transport. Recently what is known as the tin-baling machine has been introduced into several destructor installations in this country. A description of the plant in use at Blackpool, kindly furnished me by Mr. John S. Brodie (the Borough Engineer), may be of interest:—

> The tin baling press in use at our destructor works here was made by the Glendon Engine Co., of Kettering, about three years ago, and cost £150. It consists of a cast-iron chamber about 4 ft. long, 2 ft. in width, and about 3 ft. 6 in. in depth. This chamber is filled with disused meat tins and other similar articles, and then a ram, 3 ft. 6 in. by 2 ft., driven by a 20 h.-p. electric motor on a 5 in. worm shaft, is slowly forced into the chamber, and squeezes or presses up the tins, which originally filled a longitudinal space 4 ft. in length, into a more or less solid mass of from 2 in. to 3 in. in thickness by the cross-sectional dimensions of the chamber, namely, 3 ft. 6 in. by 2 in., thus reducing the bulk to about one-sixteenth of what it was originally. This enables us to load into railway trucks from six to seven tons each truck, whereas, before we had the baling machine, it was impossible to get more than about 1½ tons of loose tins into a truck or wagon. The baled tins are also more marketable in this shape than before

they are pressed, and they are now sold at about 15s. per ton at the works, the cost of labour for pressing and loading up into trucks being about 7s. per ton.

By the above process a marketable article, at a fair profit, is now produced of a waste product which before was scarcely saleable at all.

Mr. Brodie also adds:—

Fish manure is also manufactured and sold at £4 per ton, the cost of making the manure being at the rate of £1 per ton. The fish manure plant consists of an inner and outer cylindrical shell, the inner one fitted with radial arms, fixed to a centre shaft driven by an electric motor. The fish refuse is fed into the inner shell and broken up by the revolving arms. The space between the two shells, about 2 in., is supplied with live steam at 100 lbs. pressure which drives off all moisture, the vapour being led away by pipes to the main combustion chamber. After being thoroughly broken up and dried, the manure is passed through a mill and crushed to an even size, about the consistency of oatmeal, and is then put into bags for sending away.

We also make here a very considerable quantity of food for poultry out of the oyster shells collected and taken to the destructor works, which are crushed up in the mortar mill and sold at 7s. per ton.

The above uses of waste products can scarcely be called utilisation of residuals from refuse destructors (the title of this paper), but they are so indirectly, and I have thought them of sufficient interest to mention them.

With regard to the utilisation of the heated gases as a residual. For many years these have been used in connection with boilers for the generation of steam which can be used for many purposes.

There have been great discussions and a great number of experiments carried out with regard to the calorific value of house refuse. In the early days of refuse destructors great things were expected, and many exaggerated promises were made as to this calorific value; but experience has shown that, owing to the very mixed character of house refuse, not only in each town or district, but according to the seasons of the year, it is not safe to assume much more than one lb. of steam for every one lb. of refuse at a reasonable working pressure. To make full use of this steam it is of course essential that the load should be continuous, and many mistakes have been made in the past by the addition of destructors to electric generating stations where there has been a light day load, or perhaps none at all.

The following remarks by Mr. Stromeyer on fuels of weak calorific value are well worthy of consideration in connection with this matter. He says:—

"The calorific efficiency is not necessarily proportionate to the amount of carbon in the fuel. The efficiency is pulled down by the presence of incombustible matter, beyond and in addition to the diluting effect of such

matter in the coal. Supposing that with pure coal, water cost, say, one shilling per ton to evaporate, then with a coal containing 10 per cent. of earthy matter the cost would be 1·5 shillings, with 20 per cent. of earthy matter 2·25 shillings, and with 30 per cent. 4·25 shillings. In other words, coal containing 30 per cent. of incombustible refuse was only worth one-fourth as much as pure coal."

How much more do these words apply in the case of house refuse, where the proportion of incombustible refuse is often large and always variable.

With a properly constructed destructor and a proper application of the heated gases to the right description of boiler, very useful results may be made of this heat, and it has the great advantage of reducing the temperature of those gases* before ascending the chimney shaft.

I think it well to draw attention to a recent method for dealing with house refuse, which, strictly speaking, is outside the scope of my paper, that of pulverising crude house refuse into a sort of poudrette, or powder. I refer to the Lightning Dust Crusher, as installed at Southwark and, I believe, elsewhere. This consists of a comparatively small steel box, or core, containing 4 or 6 hammers, each weighing about 50 lbs., composed of a special alloy steel. The axle on which these hammers hang is rotated by machinery at the rate of from 800 to 1,000 revolutions a minute. The refuse, including all tins, bottles (in fact, everything) is fed by shovels into the machine at the rate of four tons an hour, and comes out completely pulverised, and, at Southwark, is sent away in railway wagons and sold for manure at 2s. 3d. per ton. The freight is, however, 1s. 8d. per ton, and the cost at the works is 1s. 5d. per ton, so that in this case there is a net loss of 10d. per ton. The driving power required for such a machine is said to be from 18 to 22 B.h.p.

I have seen this machine at work, and examined the poudrette, which was inoffensive to the smell, and although of no very high manurial value, is readily bought as a fertiliser, and is a great improvement on the old method of manuring with tin cans, umbrellas, and wastepaper!

A further use of this powdered house refuse has been made by Mr. H. G. Coales, Surveyor of Market Harborough, who has made fuel briquettes with it by mixing the poudrette with tar compounds. He claims for these briquettes that they have a calorific value of one-third that of best coal, as 1 lb. of his briquettes will evaporate about 3 lbs. of water, and that the cost of producing his briquettes is only 4s. a ton including labour, power, ingredients, depreciation and loan charges. This includes a complete

* These gases contain carbon dioxide, carbon monoxide, oxygen, and nitrogen, the latter gas being generally at least 78 per cent. of the whole.

installation of lightning crusher plant and the necessary machinery, which he estimates will cost only £2,000 to deal with 10,000 tons of house refuse per annum.

It is evident that although house refuse is a waste product in itself we should endeavour to make all the use possible of the residuals from it which follow combustion. The tendency of the age and of scientific investigation is to make use of waste products, and we have Nature herself setting us a good example. Nature denies there is such thing as waste. Her great laboratories slowly change *death* into *life*. Decaying matter feeds the living plant, and the great endless circle is maintained.

"Thus should we learn a lesson positive
That waste and dross are non-existent all,
And that man's aim and objective
Should be the use of all things great and small."

[*For Discussion on this paper, see page 637.*]

UTILISATION OF RESIDUALS FROM REFUSE DESTRUCTORS.

By W. J. STEELE, A.M.Inst.C.E,

Deputy City Engineer, Bristol.

THE disposal of town refuse in such a manner as not to be injurious to the public health, is a problem in local government which has become acute during the last fifty years by reason of the great increase in the population of towns and the consequent crowding of a large number of people on a more or less confined area.

Dr. Farr states, "It is well established that the mortality of the populations of the cities is generally higher than the mortality of people in the country. And it has been shown in the annual reports that there is a constant relation between the density of the population and the mortality. When any zymotic matter, such as varioline, scarlatinine, or typhine, finds its way into a village or street, it is more likely to pass from house to house than it is where the people are brought less frequently into contact. The exhalations into the air are thicker. But if an adequate water supply, and sufficient arrangements for drainage and cleansing are secured, as they can be by combination in towns, the evils which now make dense districts so fatal, may be mitigated. Indeed, some of the dense districts of cities are in the present day comparatively salubrious."

Although the density in population in towns has considerably increased during the above named period, there has been a notable decline in the general and zymotic disease death rates; this is probably due to many causes, but it may safely be assumed that an improved application of hygienic principles has been an important factor, and one principle in hygiene is the rapid destruction of any matter liable to be a source of danger to the public health.

The methods at present usually followed in refuse disposal are as follows:—

1. Filling low-lying land with the crude refuse, such land being temporarily designated a tip or shoot. 2. Discharging the crude refuse into the sea at a convenient distance from the shore. 3. Stacking the crude refuse on waste land more or less remote from a town, and firing it. 4. Burning at a refuse destructor. 5. Pulverising the crude refuse by machinery and using the product for manure, or in the manufacture of fuel by an admixture of tar. 6. Separating the crude refuse by hand or machinery, and using the constituents in such trades as can profitably employ them.

No. 1 is perhaps the simplest and cheapest method in those towns not too remote from suitable land. It has considerably enhanced the value of land in some instances, and under favourable conditions is not to be ignored. As, however, it undoubtedly causes discomfort and inconvenience to any inhabitants near a tip, if not a source of danger to their health, it can only be adopted under the exceptional conditions where suitable land is available within a reasonable distance of the point of collection.

No. 2 is only possible in seaports, and even then is an expensive and wasteful procedure.

No. 3 is similar to No. 1, and subject to the same advantages and disadvantages, except that any organic matter is destroyed more quickly.

No. 4 is undoubtedly the most effectual in fulfilling the condition that all organic matter liable to become a danger to the public health shall be immediately rendered innocuous. In some towns, however, such a large volume of harmless material has to be burnt in order to destroy a comparatively small quantity of organic matter, that it is a question whether some other method than the installation and working of somewhat costly plant such as refuse destructors, cannot be adopted.

Nos. 5 and 6 are on their trial, and will be carefully watched by those responsible for controlling refuse disposal, as they have many possibilities in districts where a ready market can be found for the products.

In the utilisation of residuals from a destructor, much must depend upon the power of the particular locality to absorb them; and in selecting a site for the works, this fact should have consideration.

Heat.—Heat may be classed as a residual of the destruction of refuse by burning, and it is occasionally placed in the foreground by some manufacturers of plant as a reason for installing a destructor; but the only justifiable reason is the immediate destruction of matter injurious to

health, the generation of heat being only one of the means employed in reducing cost.

The amount of energy created of course varies in different towns, and at the several seasons of the year in the same town; but assuming a town in the United Kingdom of 50,000 inhabitants with refuse of an average character, at least 150 indicated horse power can be obtained during most periods of the year, or sufficient to generate about 800,000 units of electricity per annum. Where this energy is utilised in pumping plant for sewage or water supply or in assisting electricity generating stations, a considerable credit may be placed against the cost of burning.

In Bristol, if the total energy used in cutting timber for wood paving, depot cranes, fodder machinery, concrete slab machinery, mortar mills and general workshops, was obtained from the destructor, about 110 horse power would be required for 2,600 hours per annum; but although only about one-third of the total quantity of refuse is treated at the destructor, sufficient energy to supply 400 horse power during any part of the above named period might be obtained, if steam raising was all important. The only use now made of the heat is to drive mortar mills and clinker crushing plant, but further utilization is under consideration.

In the discussion on a paper on "Municipal Refuse Disposal" read by Mr. J. T. Fetherston, Assoc.M.Am.Inst.C.E., before the American Society of Civil Engineers (Transactions, Vol. LX.), it was suggested that ice might be manufactured by installing an absorption ice machine and utilising the steam from a destructor plant, a 50 ton destructor being estimated to produce 50 tons of ice per day. The market price for ice in England is low, and it is very doubtful if this means of using the steam would recoup the extra cost of installing and working the ice plant, although it may be justified in the United States.

Another suggestion made during the same discussion, was the adoption of electric collecting wagons, driven by storage batteries charged at the destructor, so that the saving on the present methods of collecting the refuse by horse haulage, might be set against the expenditure in running the destructor. This seems feasible if a satisfactory wagon can be evolved.

The disposal of the solid residue of the treated material is, after all, the most difficult part of the subject under consideration, and this opens up the larger question of only burning that portion of the refuse likely to contain organic matter, everything except ashes, metals, bottles and material of a like nature. Organic waste (garbage) is separated from the

ashes and rubbish in the large cities of the United States, and this is known as the reduction system, but for a new installation in the Borough of Richmond, New York, a "mixed refuse" destructor was recommended, on the ground that not only was "mixed refuse" destruction more sanitary than the separate disposal of ashes, garbage and rubbish, but it would avoid the annoyance caused to the householder by the system of having two bins, and further, a collecting wagon containing garbage only, was offensive whilst on the streets.

The general practice in England of burning the whole of the refuse except metals, bottles, etc., is costly, inasmuch as not only has a larger volume of material to be treated than by the separation system, but the percentage of resulting clinker is very much higher on account of ashes forming such a large proportion of the crude refuse: however, it has the great advantage of forming better combustion in the destruction of the garbage.

Glass, Metals, Pottery, etc.—The average amount of refuse collected from towns in the United Kingdom is about 570 lbs. per head per annum, and in this quantity there are about 25 lbs. of glass, metals, pottery, and like material, which in a town of 50,000 inhabitants will amount to about 560 tons per annum. Some method of intercepting most of these materials before burning the refuse is adopted at most destructors, the attention paid to it depending upon the marketable value of the recovered material in the locality, and it is conceivable that in some cases a proper mechanical or hand system might profitably be installed.

Resultant of burnt refuse.—The residue of the average refuse burnt may be taken as 33 per cent. of the original weight, and consists of clinker, ashes, flue soot, and dust. The flue soot and dust do not amount to a large proportion, and little difficulty is experienced in disposing of them for agricultural purposes or forming a base for disinfecting powder.

The popular means of disposal of the clinker and ashes is to use them as a substitute for stone, and so far as the author is aware, no other method has yet been available. Whether they are used in combination with cement, lime, asphalte or tar, clinker or ashes can never have the same properties as stone, and they are consequently most valuable in a district remote from a quarry. Where there are stone quarries near a town it may be more economical in some sections of that town to use the "spawls" or waste from the quarries than to haul clinker from the destructor; hence in such a town the difficulty of making full use of the residuals is obvious.

In Bristol, the utilisation of these products is carried out as described below:—

Population 1908 (estimated)		372,785
Length of highways in miles (about)		342
Refuse collected per annum, in tons		95,000
Refuse received at destructor per annum, in tons		32,216
Resultant of burnt refuse, in tons		10,313
Resultant of burnt refuse, if whole of collected refuse was burnt, in tons (estimated)		30,411
Resultant annually required for municipal purposes, such as road foundations, concrete slabs, pavements, mortar, etc., in tons ...	5,161	
Resultant sold to the public, in tons ...	3,133	
Total utilised, in tons		8,294
Percentage of resultant utilised		80
Percentage of resultant utilised, if whole of collected refuse was burnt...		27

That only 80 per cent. of the resultant of the burnt refuse is utilised is due to the fact that there are several quarries in the city which form formidable competitors to the disposal of the product, but the question of making further use of the material is under consideration and probably the whole output will be utilised. Assuming that Bristol was remote from a stone quarry, and that the whole of the collected refuse was burnt, the most of the resultant that could be used would probably not exceed 15,000 tons per annum, or about 50 per cent. of that produced, but the remaining 50 per cent. could be absorbed in filling worked-out quarries, clay pits and low-lying lands where the tipping of crude refuse is prohibitive.

Concrete slabs for footways are made by three methods, by hydraulic pressing plant, rocking machine, and hand labour in wooden moulds; window and door heads and sills, steps and other artificial stone dressings are made by hand labour in wooden moulds. The slabs are composed of clinker mixed in the proportion of three parts of clinker to one part of Portland cement; the slabs are faced with granite chippings in the proportion of three parts of chippings to one part of portland cement.

1 ton of clinker will make 16 superficial yards of concrete flagging.
1 „ granite siftings will face 60 „ „
1 „ cement will make 45 „ „
1 „ 2 inch flags is equal to an area of 10½ square yards.

A series of absorption and breaking tests were recently carried out, but so many conflicting results were obtained, that it has been found necessary to considerably extend them if they are to be any guide; the most

trustworthy test, however, is the daily use of the materials. That concrete slab pavements largely composed of destructor clinker are satisfactory, has been fully proved in Bristol, about two miles being laid each year. Some of the pavements have been under heavy traffic for more than twelve years and are still in good condition, which is more than can be said for some Pennant flagging in use for the same period.

Hydraulic Press.—This plant consists of two rams, one forcing the filled mould under the top bed and the other applies the pressure. The mould is then withdrawn from under the top bed, turned over, the slab is dropped on to a trolley and run out to the drying shed. The pressure on each slab is 2 tons per square inch. The area of slabs made in one day of 9½ hours is 97 square yards, and the cost of production 2 6 per yard, inclusive of first cost, depreciation of and repairs to the machine.

Rocking Machines.—These are the invention of the works superintendent, Mr. W. H. Baker, and consist of an iron perforated mould, mounted on a cam shaft; by turning the shaft a rocking motion is given, this allows of the surplus water filtering through the perforations, secures a homogenuous mixture and a thorough consolidation of the materials. The area of slabs made by one machine in a day of 9½ hours is 30 square yards, and the cost of production 2s. 1d. per yard.

Hand Labour.—Slabs and building dressings are made in wooden moulds by hand, the cost of production being 2s. 4d. per square yard for slabs, and 2s. 8d. per cubical foot for dressings.

Manufacturing paving setts by mixing the clinker with asphalte is now being tried in a London borough, but as this is still in an experimental stage, no data is to hand as to the success of the process.

Brickmaking has been in operation at West Hartlepool for some time, and from some valuable information given by the borough engineer, Mr. Nelson F. Dennis, Assoc.M.Inst.C.E., the following facts are given:—

6 per cent. of slaked lime is used in the manufacture.

Crushing test per square foot	218 tons.
Absorption of moisture by weight.	7 per cent.
Cost of making bricks per thousand ...	17 shillings.
Total cost of plant and buildings	£3,025.

The bricks have been used in building manholes on sewers, stable premises, and extensions of the electricity station, but their general use in external work is not recommended.

The author has endeavoured to show that, as in most questions affecting municipal work, local conditions are the predominating factor; but probably in every case where town refuse is burnt in a destructor there is

ample scope for development in utilizing the residuals beyond what has already been accomplished. It is suggested, however, that this alone is not a sufficient deterrent to the installation of a destructor, as the outstanding feature of its use is the effectual destruction of matter which may be injurious to the public health, and as this may be accomplished in most cases at a total annual cost of not more than one penny in the £, it is a justifiable expenditure.

[*This Discussion applies also to the paper by* MR. H. P. BOULNOIS, *page 624.*]

MR. A. E. NICHOLS (Folkestone) did not agree as to the non-suitability of refuse clinker for tar macadam. He had, three and a half years ago, put down a boys' school playground, having an area approximately of 500 square yards, in tar macadam composed entirely of refuse clinker. The playground had been used to a very great extent, and the surface was at this moment in a very good state, the clinker never wearing slippery, but always permitting a good foothold and practically no dust being found.

He was surprised at the high figure quoted by Mr. Steele as the cost of making concrete flags, and considered that that figure ought to be considerably reduced, his experience being that flags could be made at a much lower price and still be of the very best manufacture.

MR. H. A. GARRETT (Torquay) said that it had been generally conceded that the primary object of a destructor was the disposal of town refuse at the cheapest possible cost, utilising as far as possible the products of combustion at a reasonable cost. He agreed with Mr. Boulnois that the utilisation of clinker for road-making was not suitable, but clinker laid as a foundation for public walks in pleasure grounds, topped up with fine ash from the ash-pan of a destructor, well rolled and consolidated, then tar painted and dusted with fine sand, made a most useful path. The flue dust was used in his district for drilling-in turnips.

The calorific value of refuse varied in every town. At Torquay, where coal was 26s. to 28s. a ton, there was no waste, the calorific value of the waste was very low as compared with that in the Midlands, so that the same results could not be obtained; but he had various appliances at work, and had a small electrical installation for lighting the works, and a few street lamps in the vicinity of the destructor. He had also laid footpaths by adding a little lime to the ground clinker, and then adding a small proportion of cement thoroughly mixed and laid and rolled. That had made an excellent path for secondary roads.

MR. C. H. COOPER, MR. E. G. MAWBEY, and MR. A. E. COLLINS also took part in the discussion.

PLANTING STREET TREES.

By W. W. PETTIGREW,
Superintendent, Parks Department, Cardiff.

The Value of Street Trees.

THE presence of trees in the thoroughfares of towns and cities adds no less to the comfort of the inhabitants, by producing a certain amount of shade in the summer and protection during the winter, than to the adornment of the streets. In addition, they become, on account of the peculiarities of their plant economy, one of the purifying agencies of our cities during at least the summer months of the year. Under these various circumstances, tree planting in public streets is recognised as one of the duties incumbent upon all local authorities claiming to be up to date.

In the laying out of the ideal cities of the future, ample and proper provision will no doubt be made for the judicious use of trees in their streets, as well as in the roads leading to and from them. Unfortunately, from the haphazard manner in which streets have in the past been laid out in the majority of towns, there is hardly enough provision made for ordinary vehicular traffic, let alone for the planting of trees in the footways, and as a natural consequence trees do not take the place they ought in town ornamentation. When it comes to a question of æsthetics (which, after all is the most apparent point in favor of street trees) against public safety or even convenience, there can be no two opinions as to which must give way; hence, where streets or footpaths are narrow, trees will not be planted.

Necessary Regulations.

Most local authorities have their own regulations as to the minimum width of streets and footpaths in which trees may be planted. In Cardiff no street in the residential quarters less than 45 ft. wide is allowed to be planted with trees, while in the business parts the footways are generally so narrow that, even where the streets are considerably wider than 45 ft., it has never been thought advisable to further impede foot-traffic by planting trees. Within the last ten or twelve years, several streets, originally made with private dwellings, have had these gradually converted into business premises, and in a great many instances the street trees have had to be removed at the request of the tradesmen, who considered that they interfered with their business. Had the footways between their premises and the carriageways been two or three times wider than they

were, the probability is that they would have regarded such trees more as an advantage than otherwise.

Even in the residential parts of a town it is not advisable to plant trees in the streets where there are no front gardens between the pavement and the dwellings, as very often the drawbacks arising from their presence under these conditions are much greater than the advantages.

The distance at which to plant tree from tree in public streets is often a matter which is decided by the individual taste of those officials responsible for carrying out this work. On the Continent it is, I understand, the rule to have them planted as closely together as possible, but in this country, where the heat and sunlight are not so intense during the summer and where shade is not such a desideratum, there is not the same necessity for close planting. It has long been the rule in Cardiff to plant the larger growing kinds of trees at 60 ft. apart and the fastigiate forms at half that distance. When planted at these distances apart they should not be placed directly opposite each other on either side of the street, but alternated, as in this way the distance from tree to tree does not appear to be so great as it really is. Owing to the presence of gas and water pipes, and other impediments, it is impossible to keep the distance exactly uniform, but these distances are approximate.

Choice of Trees Suitable for Street Planting.

Judging from the paucity of species used in a great number of towns, there would appear to be but few kinds of trees suitable for street planting. This, however, is fortunately not the case, as there is in reality a great number of different species and varieties of trees most suitable for planting in towns, especially in the southern counties.

As a rule only deciduous trees are utilized, as they are better adapted for town work, on account of the yearly shedding of their leaves, than evergreens usually are. In towns where smoke is not one of the important factors to be taken into consideration there are a number of Conifers which would be found to be exceedingly useful for street planting where plenty of room could be given to them. In the Garden Cities recently laid out I understand these play a very important part in beautifying the streets and roads. On the other hand, as showing the pernicious effects of smoke upon this class of tree, it may be as well to point out that it is almost impossible to find a single specimen of any age growing in London. Where Pines and Cedars once flourished, in the vicinity of Chelsea, no trace of them is to be found to-day. I mention this to show that where other conditions may be favourable to Conifers it is useless attempting to grow them where smoke has to be contended against.

*

While the question of soil and locality must always necessarily have a very considerable bearing upon the number of species from which a selection can be made, the greatest determining factor is probably the kind of youthful inhabitant which has to be reckoned with. There are a great many kinds of trees which, in addition to bearing good foliage, produce an abundance of beautiful flowers, and afterwards equally showy fruit. If these were only allowed to grow and develop without being wilfully damaged by youths and children, they would not only beautify our streets, but also add greatly to their interest. A great number of species of Thorns, Pyrus, and Prunus, as well as the flowering Ash, Horse Chestnut (white and scarlet), Catalpha, Laburnum, etc., come under this category, all of which would do well if planted in the suburban parts of towns.

Alas! notwithstanding our much vaunted educational systems, the great majority of our town youth are apparently lacking in the fundamental principle of all true education, reverence, and thereby fail to appreciate the efforts of city fathers in trying to beautify the streets with the rarer trees. In this country young people seem to regard flowers and fruits, when growing in public places, as something to plunder, or as so many targets to be thrown at!

Besides flowering trees there are a number of different species, such as the Liquidambar, Copper Beech, Prunus Pissardi, and several forms of Acer, which, bearing red or variegated foliage, produce striking colour effects. If such flowering and coloured-foliage trees are not likely to be damaged by children, then the extra cost will be amply repaid by the pleasing effects they ultimately produce.

Restricting the Growth of Trees.

In planting trees in public streets, it must always be borne in mind that the conditions under which they are to be grown are perfectly unnatural, and that their treatment must be in keeping with their artificial surroundings. Instead of permitting them to develop into timber or spread out their branches as far as they can, it is the object of those who have care of them to restrict their growth and expansion, and so keep them within bounds. To carry out this (entailing an annual pruning) adds considerably to the upkeep of street trees, hence it is a wise economy to use fastigiate forms wherever they are suitable.

A Few Practical Details.

There are some matters connected with this subject (apparently trivial in themselves) about which I feel it necessary to make a few brief remarks.

Trees bearing stunted growths (unless planted with a direct object)

should never be used, for the conditions under which they must necessarily be grown in streets is not conducive to their growing out of any such defects. Free growing, clean, healthy trees are the best to plant under all circumstances, but more especially is this so in the case of street planting.

Again, trees for this work should be planted as early as possible after the fall of the leaf, so that the soil immediately around their roots may be enabled to get the full benefit of the winter rains. When the soil on the site where a tree is about to be planted is not good, it is in the long run the best economy to clear it out and put in fresh loam. Whenever and wherever possible iron gratings should be used for covering over the soil above the roots in preference to paving stones or even gravel. The use of gratings enables moisture and air to reach the young roots, without which it is impossible for trees to flourish.

We never find it wise to plant any tree under 10 ft. in height, nor with less than 6 ft. of a clear stem.

In addition to providing newly planted trees with adequate support, it is invariably necessary to protect the stems from damage. It is the provision of this protection, together with the iron gratings just alluded to, which makes tree planting expensive.

In quiet county towns trees are sometimes sufficiently protected by means of three stout stakes placed at equal distances around and at about 18 in. from the base of the stem. These are joined together at about 5 ft. 6 in. from the ground, and the point of attachment used as the support to which the tree stem is securely fastened. Such a cheap form of protection cannot be used in many towns, hence the necessity for providing iron tree-guards, which cost from 15s. to 35s. apiece.

The last point in connection with this practical phase of the question which I wish to allude to is the necessity of never allowing a permanent branch to develop from the tree until there is at least a clear stem of 12 ft. If branches are allowed to grow out lower down the stem than this they are sure to interfere with ordinary vehicular traffic.

List of Suitable Trees.

The following is a short list of, and a brief commentary upon, some of the trees generally used for street planting.

The Oriental Plane is without doubt the ideal town tree, as it is for many reasons better able to withstand the hard usage which trees growing in populous districts have invariably to put up with. It bears large glossy leaves, from which the dust and soot are washed off after every shower of rain, and it thus retains its freshness for a good period of the year. It sheds its bark every few years, and so gets rid of its soot-clogged

outer coat, for which it is all the healthier. The Plane bears any amount of pruning, a fact which stands it in good stead as a street tree.

While the typical English Elm is not suitable for planting in towns, owing to its being a shallow rooter, and its large branches being liable to snap off at their base without the slightest warning, even on a fine day, yet there are two or three varieties of it, and a nearly allied species (the Wych Elm) which are very well adapted for street work. These are the Cornish Elm, the Cork Elm, and the fastigiate Wych. These trees do well in the vicinity of the sea, as may be noticed in this neighbourhood.

Where the soil is of a heavy, clayey nature, few trees do better than Poplars. A number of different species are inclined to make very strong growth, but as they stand pruning remarkably well this does not preclude their use in towns. The fastigiate forms, however, are the best where they can be used, as they do not require pruning. The two most useful species are *Populus nigra var. fastigata*, the Lombardy, and *P. alba Bolleana*. These are well adapted for growing in a long, straight road, at the end of which there is a pile of fine buildings or other imposing background.

The Turkey Oak and the Scarlet Oak are suitable subjects for wide streets where they can get plenty of freedom. One point in favour of the latter species is the fact that in the colder, drier districts of this country its leaves take on a beautiful scarlet colour in the late autumn, which makes it a very beautiful object to look upon.

Among the Sycamores (Acers) there are a great variety of most useful trees admirably suited for street planting. Some of these have yellow, some variegated, and others copper and red foliage, and all are easy to grow. One word of warning regarding the pruning of these is needed. As the sap rises so early in the year in this genus, it is well, when they require any pruning, to put this work in hand immediately after the leaves have fallen: otherwise, if left later, the cut stems bleed very profusely.

The Ailanthus (the Tree of Heaven) is a very ornamental tree, which in suitable quarters attains a fairly good height. It bears very large leaves of the Ash type, and is well worth growing as a street tree.

The Birch we find useful in streets where we do not want very robust growing trees. Its drooping habit, together with its silver bark, give it a picturesque appearance, either during the time it is in leaf, or when denuded of foliage in the winter.

The Mop-headed Acacia is one of the best species for growing in places where only trees of the most restricted growth can be tolerated.

[*For Discussion on this Paper see page 646.*]

TREE-PLANTING IN STREETS.

By C. CHAMBERS SMITH,

Engineer and Surveyor to the Sutton (Surrey) Urban District Council.

(MEMBER.)

THIS subject has not received the attention of local authorities which it deserves. Persons who have travelled on the continent and who know some of our own towns on the south coast cannot fail to have been impressed with the attractiveness which trees add to thoroughfares and to the buildings which abut upon them. The hard ugly lines and the equally unæsthetic colours which are usually prominent in the domestic architecture of the present age are softened and their asperities reduced by the cloak which is afforded by the green foliage of the trees which the authorities of those towns in their wisdom have established. Under the glaring heat and the dazzling rays of the mid-summer sun, such trees give a welcome protection and relief to the eyes and the body of the pedestrian. To the merchant and to the toiler who are compelled to work in factories, warehouses and shops in districts where bricks and mortar are supreme and green foliage is absent, the relief and rest afforded by trees in thoroughfares where he resides are appreciated to an extent which is not generally understood by local authorities. Indirectly, tree-planted streets serve to add to the rateable value, in the same manner as the presence of matured trees around a residence add to its rental value. It is therefore a matter for the consideration of local authorities whether prudent expenditure on the planting of trees in public streets is not profitable for the towns which they administer.

Until the passing of the Public Health Acts Amendment Act, 1890, it was doubtful whether local authorities could lawfully plant trees in public roads. But by the provisions of section 43 of that Act it is enacted that "an urban authority may if they see fit cause trees to be planted in any highways repairable at large and may erect guards or fences for the protection of the same."

The power is restricted to urban authorities only, and rural authorities can only legalise the planting of trees in highways by obtaining urban powers under section 5 of the Act of 1890. It should be observed as

evidence of the inability of local authorities to plant trees in highways prior to the adoption of the Act of 1890 that the Lewes Corporation were convicted on indictment, at the Sussex Assizes in 1886, of causing a nuisance to the highway by the planting of trees thereon.

There is a tradition amongst highway surveyors, from the time of of McAdam, that trees should not be allowed to grow adjacent to highways, as it is alleged they exclude sun and air, and tend to keep the surface damp. In some rural districts this tradition is still acted upon, and some surveyors use all the powers they possess to secure the removal of timber trees. It is, however, a mistaken policy, and one which is not consistent with the position taken up by surveyors generally, that roads cannot be kept sufficiently moist owing to the action of fast-moving motor traffic. On the one hand, therefore, trees which by their shade assist in maintaining roads moist are objected to, whilst a loud outcry is at the same time raised against the dust which is created by motors owing to the dryness of the road surface, and all kinds of specifics are called for to combat the nuisance.

Another objection sometimes raised is that fallen leaves constitute a nuisance, and increase the cost of road scavenging in urban districts. It may be granted that a slight additional cost is incurred in removing leaves during the autumn, but this is too infinitesimal to be serious, while the advantages accruing from the presence of trees greatly outweigh this objection.

These are the principal objections which can be raised against tree planting in public streets, and when once overcome no authorities ever desire to see the practice abolished.

During the last ten years, owing to the clear-sightedness of the local authority with which he is associated, the author has supervised the planting of some 7,000 trees in roads, and as a consequence it is probable that no town in the kingdom of similar size has so many boulevards or is so embowered with foliage, making it an especially attractive residential suburb highly appreciated by the city merchant who enjoys the relief and the change from the bricks and mortar of the metropolis.

It has been found by experience that the best practice is to plant the trees 30 feet apart and to place them within about 9 inches from the back of the kerb. Excavations are made in the path 2 feet wide, 3 feet long, and 2 to 3 feet in depth, and into this is placed up to within 9 inches of the surface, carefully selected mould with the addition of a little stable manure. The tree, which should have roots with plenty of fibrils to ensure successful growth, is planted in the centre of this and the soil is well rammed around it.

The use of iron guards to surround the trees is, the author considers, objectionable, and the cost is also prohibitive. All that he has found necessary is to provide a support for the young tree against winds by means of a stout larch pole (known as a ricker pole) about 14 feet in length, which is driven well into the ground, and the tree is secured to this by means of wire wound round it, with a strip of tarred felting to prevent the wire cutting into the bark. These ricker poles are stripped of their bark for 2 feet from the bottom, pointed, charred over a fire, and then dipped in boiling tar to protect the portion in the ground from decay.

In order to preserve the young trees from injury by youths lacerating or stripping the bark with knives, and also to protect them against horses gnawing the bark, the author uses galvanised wire netting of 1 inch mesh which he winds twice round the tree and the pole attached to it to a height of 6 feet, the ends being secured by wire; and this has been found to answer most successfully.

Time for Planting.—The best time for planting is between the end of October and the beginning of March.

Selection of Trees.—Care requires to be exercised in the selection of trees so as to suit the soil in which they are to be planted. The author's district comprises chalk soil over one half and clay over the remainder. Trees, however, such as planes, which thrive luxuriously on clay cannot be made to grow on chalk, and limes, which are very successful on chalk, will not thrive on clay. He has found limes, horse chestnuts, beech, sycamore, Norwegian maple, and Camperdown elm, answer on chalk soils, whilst on clay soils the plane, sycamore, horse chestnut, maple, and Camperdown elm have been extensively planted. Care is, however, taken to plant different varieties alternately and not to have one variety running along any street.

In specifying for the supply of trees the author requires that the circumference of the stem at the ground level shall not be less than 7 in. and that the lowest branch must be at least 7 ft. from the ground level, whilst the roots must show healthy fibrils as distinguished from tap-roots. As the tree grows the lower branches are lopped until the lowest branch is not less than 10 ft. from the ground.

Cost of Planting.—This is as follows, viz.:—Ricker poles, 1/3; tree, 3/–; wire, 1/–; soil, manure, labour, and cartage, 3/6. Total, 8/9 per tree.

In order to encourage the planting of newly developed streets, my Council some years ago inaugurated the system of planting such streets immediately prior to their being made up under the Private Street Works Act, 1892, providing the owners contributed at the rate of 2d. per foot

frontage of their premises, the balance of the cost being borne by the Council. This method has been much appreciated, and owners willingly pay this sum to secure the carrying out of the work, recognising the influence of tree-planted streets on the letting value of their houses, whilst each year the Council continue to plant at the cost of the rates in streets adopted as highways and which have a width of not less than 36 feet, such a number as will ensure that in a very few years the whole of the streets, which are not already bordered by overhanging trees from private gardens, are planted with trees.

From the hygienic point of view much could be said in support of the practice of tree planting in towns, and as to the purification of the atmosphere by the absorption of carbon dioxide and the liberation of oxygen by the leaves of the trees. Sufficient has I trust been shewn to indicate to local authorities the importance of the subject of tree planting in public roads so as to enhance the amenities of town life, and to render towns attractive and more healthy.

[*This Discussion applies also to the Paper by* Mr. W. W. Pettigrew, *page 638.*]

Mr. J. S. Brodie (Blackpool) stated that he had experienced the greatest difficulty at Blackpool in getting trees to grow satisfactorily in the streets, and if Mr. Pettigrew could give some hints as to how this difficulty could be overcome on the exposed foreshore and other parts of Blackpool, he would be glad. He had fought this question of tree planting by the sea for many years now with varying success, but he thought his prospects now were better owing to the help which he obtained from an exceptionally able practical gardener. He had found that sycamores and Scotch elms were the most successful trees in exposed positions.

Mr. H. A. Garrett (Torquay) quoted his experience at Torquay, where the foliage was most profuse, and the greatest difficulty he had experienced was the keeping of the trees within bounds. He was sorry Mr. Pettigrew had omitted the lime. The lime at midsummer was a most beautiful tree, and the lovely aroma on a June morning from the lime avenues at Torquay was the pride of the town.

He recommended lime and plane planted alternately; these trees, although late coming into leaf, held on their foliage until late autumn. The chestnut was not recommended, as it came into leaf very early and was liable to be frostbitten by late frost, and so have its beauty destroyed for the rest of the summer.

Mr. E. G. Mawbey (Leicester) said they had recently experienced difficulty in some of the streets of Leicester by reason of the rapid growth of black Italian poplars. In the case of one very long road, where black Italian poplars were planted some twenty-five years ago, they grew to such an enormous size, notwithstanding frequent pruning, that the residents complained very much of the obstruction of light and air and of the damp arising from them. There appeared to be only two remedies: either to remove the whole of those trees and plant new ones, or to pollard them. He adopted the latter course. Owing to the appearance of that long street of tree stumps great complaints were received at first; but to-day, as he noticed from personal inspection, on each stump had grown a beautiful top and the street was quite a picture. He did not, however, think that these trees were suitable for town streets, generally speaking, excepting perhaps for very wide thoroughfares with wide footways, and where the houses were well set back.

Alderman S. Patey (Leicester) dissented from the inclusion of the chestnut as a suitable tree for street planting: firstly, because the tree in question was a fruit-bearing tree, and consequently youths indulged in throwing stones to the annoyance of the residents; secondly, because the tree was of such full growth and close foliage that light and air were obstructed, to the loss and annoyance of the residents. Mr. Pettigrew mentioned the Catalpha tree as a suitable tree for planting. That tree was very little known in England, but was most beautiful, bearing flowers, and it was altogether very ornamental. He doubted that this tree was of too delicate a nature for ordinary planting, but given a suitable situation it would make a most beautiful avenue: though it would be unsuitable for any but suburban areas.

Mr. W. W. Pettigrew (Cardiff), in replying, said that although he mentioned certain trees as useful for street work, it did not naturally follow that they were suitable for every kind of street. The question of suitability had to be decided upon a variety of grounds, and could only be done by one on the spot.

He did not think it practicable to root-prune street trees. He feared the only way of getting over the difficulty mentioned was to plant fastigiate forms, the branches of which did not spread. It was possible to get mop-headed acacias with stems 12 ft. high by ordering them a season or two in advance from nurserymen, who would have them specially grafted.

In reply to Mr. Brodie, of Blackpool, he stated that the best trees, so far as he knew, for seaside towns were the elm, sycamore, and beech.

Mr. A. E. Collins, Mr. Hurst, Mr. C. H. Cooper, and Mr. C. Brownridge also took part in the discussion.

THE MERTHYR SEWAGE FARMS.

By T. FLETCHER HARVEY, M.Inst.C.E.,
Borough Engineer, County Borough of Merthyr Tydfil.
(MEMBER.)

MERTHYR has the distinction of having at a comparatively early period grappled with the problems of water supply and sewage disposal, for half a century has passed since the waterworks were commenced, preparatory to the sewering of the district.

The Merthyr Local Board of Health was constituted in 1850, the first chairman being Sir Josiah John Guest, Bart., the sole owner of the famous Dowlais Iron Works, at that time the largest works of the kind in the world.

On the margin of these works, planted in the lap of a steep valley near Merthyr, had grown up a dense population of toilers, living in dwellings crowded together at the rate of 50 houses to the acre; whilst all around this closely built place of narrow thoroughfares there was land unlimited, of sloping fields and hillside, an ideal site on which the township of Dowlais might have been built, a little away from the din and dirt of the ironworks. Very much the same may be said with regard to the older dwellings of the workmen at the neighbouring works of Cyfarthfa.

In 1854 Dr. William Kay presented an exhaustive report to the Local Board, in which he passes under review the local conditions in this hive of the Welsh coal and iron industries, where, the general average age at death of the 46,000 people was 17½ years, the only worse average in the Kingdom being 17 years in Liverpool. He attributes the unhealthiness of Merthyr to "vicious construction of houses, inadequate supply of water, absence of drainage, and defective ventilation of houses." With respect to the water supply, he says, "No town, probably, suffers more from the privation of water than Merthyr, though no town is more favourably situated for obtaining it in ample abundance." Water from a spring was taken round by cart and sold at Dowlais at a halfpenny a jug, but generally it was obtained from springs and spouts, many of which failed or yielded a very scanty supply in dry weather.

The works of water supply were first taken in hand, and it is curious to note that in 1849 a reservoir embankment was suggested in the Taf Fechan Valley almost at the site selected by Mr. G. F. Deacon and the author, on the plans deposited in the present Session of Parliament. By this latest scheme a lake $2\frac{1}{2}$ miles long, holding 3,000 million gallons of water, would have been formed at a remarkably small cost in relation to the quantity of water rendered available, but the ratepayers rejected it.

It was in 1858, after several projected schemes, that the Merthyr Local Board obtained an Act of Parliament for the construction of waterworks, and by 1862 the supply had been given to Merthyr from the river Taf Fechan at an intake six miles north of the town. In 1863 the impounding reservoir, with a capacity of 350 million gallons, was completed. The cost was only £82,000, including 41 miles of water-pipes from 14 inches to 2 inches diameter. It prepared the way for the sewage disposal works.

In an appendix to the annual report for 1870 of Dr. T. F. Dyke, who was Medical Officer from 1865 to 1900, Mr. Samuel Harpur, Engineer and Surveyor to the Authority, writes: "From the first constitution of the Merthyr Local Board the question of the sewerage of the district was from time to time considered, discussed, and postponed, until, in the year 1864, after waterworks had been constructed, it was again pressed upon the attention of the Board, and they desired their surveyor to prepare plans for the sewerage of the district." Such plans were presented in October, 1864, and after several months' consideration were ordered to be carried out. A prominent feature was provision for the ultimate disposal of the sewage by using it in the irrigation of land. The works were commenced in November, 1865, and completed in September, 1868. The cost was £28,000.

"Pending the decision of the Board as to the ultimate disposal of the sewage, it was turned, by temporary outlets, into the River Taff, below Troedyrhiw, in July, 1868."

The system of sewerage adopted was the combined drainage system, and the network of sewers chiefly consists of earthenware pipe sewers.

Very shortly after the temporary outlets had been made into the already polluted River Taff, complaints arose, which resulted in an Injunction by the Court of Chancery, to restrain the Merthyr Local Board from continuing to pour their sewage into the river, and from connecting house drains with the sewers, until some satisfactory process for the purification of the sewage had been devised and put in operation. The sewerage works were therefore suspended.

Again quoting from the late Mr. Samuel Harpur: "The question of the purification of the sewage was thus forced upon the attention of the Board. They found it necessary to adopt some means by which the sewage of a population of 50,000 persons should be cleansed daily, and hourly, as it issued from the sewers. Various schemes were under consideration, but none of them seemed to meet the requirements of the case, until in April, 1869 a comprehensive scheme for the disposal of the sewage by using it in the irrigation of land, was prepared by their surveyor and was at once received with general approval."

The scheme consisted in acquiring and laying out for irrigation about 90 acres of land within the district at Troedyrhiw, and 300 acres without the district, ten miles south of Merthyr, and in May, 1869, it was ordered that the surveys be proceeded with and the necessary legal steps taken. In April, 1870, an inquiry into the merits of the scheme was held at Merthyr, on behalf of the Home Secretary, who, in the following month, issued a Provisional Order for the purchase of the necessary lands, which was, after strenuous opposition in both Houses, confirmed by Parliament.

Meanwhile the Court of Chancery suggested that some means should be adopted for mitigating the nuisance, by straining the sewage before discharging it into the river, but the owners of the land at the most suitable site refused to sell, and the local authority were driven to the expedient of constructing two elongated straining tanks under the parish road. After the construction of these tanks, the Court of Chancery directed Mr. Bailey Denton to proceed to Merthyr. As the result of his visit and examination he designed and recommended the formation of natural sewage filtering areas.

In those days, there were few precedents for sewage farming on a large scale as proposed by the Merthyr Sanitary Authority, and it is not surprising that much time passed before the final decision was arrived at. Moreover, opinions expressed by the Rivers Pollution Commissioners were not altogether favourable to the general adoption of the system.

Troedyrhiw Sewage Farm.

An address at the annual meeting of the South Wales Branch of the British Medical Association, held in Merthyr in July, 1872, "On the Downward Intermittent Filtration of sewage as it is now in practical operation at Troedyrhiw," by Dr. Dyke, gives a clear account of the work done and the results obtained. The author thinks the following quota-

tions from it worth recording: "We were placed under the professional care of Mr. Bailey Denton, who, after due consideration, recommended that the new remedy suggested by Dr. Edward Frankland should be tried at Merthyr." The first volume of the report of the Rivers Pollution Commission published in July, 1870, gives an account of the extensive and interesting series of experiments made by Dr. Edward Frankland, one of the Commissioners. "The conclusions arrived at may be thus summarised: Sewage traversing a porous and finely divided soil undergoes a process to some extent analogous to that experienced by blood in passing through the lungs in the act of breathing. A field of porous soil irrigated intermittently, virtually performs an act of respiration, copying on an enormous scale the lung-action of a breathing animal, for it is alternately receiving and expiring air, and thus dealing as an oxidising agent with the filthy fluid which is passing through it. The action of the earth as a means of filtration must not be considered as merely mechanical: it is chemical, for the results of filtration properly conducted are the oxidation, and thereby the transformation, of the offensive organic substances, in solution in the sewage, into fertilizing matters, which remain in the soil, and into certain harmless inorganic salts, which pass off in the effluent water."

Straining Tanks.—The pair of straining tanks referred to were each 200 feet by 5 feet by 5 feet deep, with a centre longitudinal drain, and divided into three bays by open brickwork. The space between the walls was filled with broken furnace slag. The sludge left on the surface of the straining slag was removed and taken to the land, each tank working four or five days. These old tanks were abandoned in 1896 because of the nuisance of clearing the sludge close to the highway. The sewer was diverted, and a pair of new tanks designed by the author were built on the farm. The sludge is removed by means of light steel tipping wagons, running on a two feet gauge railway, slightly falling in the direction of the load.

Filtration Areas.—About 20 acres of the farm were laid out by Mr. Bailey Denton into four separate filtering areas, and under-drained to a depth of from five to seven feet. The land has a loamy soil 18 ins. thick overlying a bed of gravel. Lateral drains about 60 yards apart run towards the main or effluent drain, which is six feet deep. The beds were made to slope towards the main drain by a fall of 1 in 150.

"Along the raised margin of each bed delivering carriers are placed. The strained sewage passes into the carriers, and runs gently into and

along the furrows to the lowest and most distant part of the plot. The sewage continues to be so delivered for six hours, then an interval of 18 hours' rest takes place, and again the land is thoroughly charged with the fertilising stream. The water percolates through the six feet of earth and reaches the lateral drains, which convey it to the main effluent."

Dr. Dyke continues, "In a letter received from Dr. Edward Frankland he says, 'Of the effluent water from these downward filtering areas the result is highly satisfactory, more so even than that which I had before obtained in the laboratory of the Rivers Commission.'"

It is interesting to observe that in 1890 (the farm had been worked for twenty years) Dr. Frankland, in his evidence at the county council inquiry at Pontypridd, expressed his opinion that the 70 acres of land at Troedyrhiw would be well able to purify the sewage of treble the population draining to it, or of 2,143 persons per acre, and that Dr. Dyke believed that the land was as fitted to receive the sewage as in 1871. Trial pits had been sunk 5 feet deep at various places on the farm, and it was found that below 12 or 15 inches the gravel and sand subsoil was surprisingly clean.

The method of *systematic* intermittent filtration of the 20 acres, first practised in the early days of the farm, as before described, had been for *many years discontinued*, and is now *intermittent only at the discretion and judgment of the farm manager.*

The cost of laying out the twenty acres of filtration area, including engineering expenses and charges, exceeded £4,000.

Surface Irrigation.—Adjoining the filtration areas the remaining fifty acres were laid out for surface irrigation by Mr. Samuel Harpur at comparatively little cost, and the results have been satisfactory.

Owing to the subsidence of the ground by reason of colliery workings the drainage of the farm of late years has been attended with great difficulties, and a considerable sum of money has been and is being spent in continuing the effluent conduit to a point nearly half a mile below the boundary of the farm.

The cultivation of the twenty acres of filtration area is done by the committee. Rye grass, cut three or four times a year, occupies about one-third of the area, and roots (mangolds, swedes, carrots), cabbage and potatoes a third, the remainder being arable and fallow for the general rotation of crops. Most of the surface irrigation land is let by public auction in April every year to tenants, for grazing and hay crops, and realizes an average of £8 per acre for the months between April and the

end of December. It is kept in the hands of the committee until the following April.

The Lower Sewage Farms near Abercynon.

Before dealing with these farms, situated outside the county borough of Merthyr, it will be appropriate to refer to the Agreement made in January, 1878, between the Merthyr Local Board and the Aberdare Local Board, the effect of which is, that the sewage of the Aberdare district is taken over and disposed of on the farm lands, and the control and management of all the sewage farms is in the hands of a joint committee, consisting of seven members, four appointed by Merthyr and three by Aberdare. Since the formation of the Joint Farms Management Committee, an agreement has been entered into to take over and dispose of the sewage of the Mountain Ash Council's district (excepting Abercynon), and also the sewage of Trelewis in the Gelligaer district.

In clause 10 of the deed it is laid down that the Farms Management Committee are "to determine the system upon which the farming is to be pursued, it being a condition precedent that profit is to be subservient to the proper disposal of sewage, without creating a nuisance."

The main sewer for discharging the sewage of the county borough of Merthyr on to the "Lower farms" is about $6\frac{1}{4}$ miles in length from the Troedyrhiw straining tanks to the Merthyr straining tanks at Parknewydd Farm, and consists mainly of a 24-inch brick barrel culvert with wrought-iron tubes where valley depressions occur. The serious subsidences caused by coal mining have greatly affected the sewer as originally laid.

The area of the lands originally acquired has been lessened by the giving up of several acres for colliery works, railways and sidings. The actual area of the portions of the various farms under sewage treatment is as follows:—Upper Common, 32 acres: Ynyscadudwg, 83 acres: Parknewydd, 42 acres; Berwerdy, 55 acres: Glyncoch, 13 acres.

Before the sinking of the new colliery pits, the Merthyr sewage was distributed on the lands east of the river and was only strained at Troedyrhiw. The author carried out a diversion of the original sewer, syphoned it across the river, and constructed a pair of straining tanks on the west side, near the Aberdare tanks. The Merthyr tanks are each 158 by 9 feet, and $6\frac{1}{2}$ feet deep, divided into two settling and four straining compartments: the sludge is run out on to land at a lower level, by the opening of hinged covers over pipes laid from the bottom of each compartment at a steep gradient. Owing to the difficulty and expense of

transport the sludge is a drug upon the market, nevertheless, many tons have been sold from time to time. The straining material in the tanks is the gravel of the district.

The whole of the land of the lower farms consists of porous alluvial soil about 16 inches thick overlying a thick bed of gravel, a section of which is visible near the effluent. The existence of the gravel subsoil has obviated the necessity of draining the land except to a very slight extent.

The farms are all treated by surface irrigation. The population draining on to them is estimated at 105,000.

The lands are for the most part laid down for grazing purposes and hay crops, and are let by public auction every year for the months between April and December, the competition usually being keen amongst farmers, butchers, cattle-dealers, and milk-vendors. The average price realized is £5 per acre. During the summer there are frequently 40 to 50 milch cows, 500 to 700 sheep and 40 to 50 horses on the lands, which are chiefly used as accommodation land. When it is necessary to clean the land through weeds becoming plentiful (and they generally appear in hollows of the land and along the margins of the surface carriers), it is done by ploughing and turning to summer fallow, and planting with roots or potatoes the following season.

Cattle and horses will often drink sewage water as it flows along the distributing channels with no ill effects. No animal dies on the farms. No case of typhoid has ever been traced from cattle grazing on the farm lands. No illness of workmen on the farms has been traceable to their occupation. An old servant who worked for 33 years on the farms recently died at the respectable age of 84. Some workmen on the farms have been working over 20 years and residing in cottages on the farm lands. 11 men are generally employed, three of whom are "watermen."

At the southern end of the Ynyscadwdug farm some three acres of the land have been rented for football playing.

With respect to the analyses of the sewage and sewage effluents, the periodical reports of the county medical officer contain tables which invariably show that a satisfactory result is obtained, the average percentage of purification calculated on the oxygen absorbed being about 85 at Troedyrhiw and 89 at the lower farms, and on albuminoid ammonia 86 and 92 per cent. respectively.

It may be fairly claimed that the working of the Merthyr Sewage Farm, both at Troedyrhiw and Abercynon, has been successful, and while the stipulation that "profit is to be subservient to the proper disposal of sewage" has been strictly adhered to, the pecuniary result has been

satisfactory. Taking an average over the last 10 years, the yearly general expenditure on all the farms has been £1,941 4s. 9d. and the yearly revenue £2,744 17s. 4d., showing a profit over and above the working expenses of £802 12s. 7d. per annum. The loans acquired for the purchase of lands have in most cases been repaid. The profit is applied by dividing it between the Merthyr and Aberdare Councils in the proportion of the populations of the respective districts, or by carrying out works chargeable to capital account.

Judging by the results of operations extending over many years, there appears to be good reason for adopting the system of using sewage as a land fertiliser, wherever suitable land can be obtained, and such land is not infrequent in river valleys. If possible, take sewage to the hungry land, not to the sea.

Mr. E. H. Crump (Hinckley) said one question which he would like to ask was whether or not the yearly interest and repayment of instalment of loan were included in the expenditure stated in the paper. After inspecting the crude sewage arriving at the farm he noticed it was free from trade wastes, and was simply domestic sewage. This, together with the fact that the subsoil of the land upon which the sewage was irrigated was of excellent sand and gravel, resulted in such a clear effluent, and contrasted greatly with the conditions which prevailed at the Hinckley sewage farm, of which he had the control. There 50 per cent. of the daily flow consisted of waste liquors from dyeworks, and the 130 acres which comprised the farm were of yellow and blue clay. One could imagine the great difficulties which had to be contended with in such a case to obtain a good effluent. The straining channels appeared to do their work efficiently, but he was afraid that if the sewage contained a great amount of matters in suspension, and also trade wastes, some difficulty would be experienced in keeping them from being choked. If all sewage farms had similar conditions as at Merthyr, all the difficulties with which engineers were at present confronted would disappear. Mr. Harvey and the farm manager were to be congratulated upon the condition and success of the farm.

The Proceedings of the Congress will be continued on page 657.

DECISIONS OF COUNCIL ON RESOLUTIONS PASSED AT THE CARDIFF CONGRESS, 1908.

Resolution passed in Section I.—

"That, in the opinion of this Conference, it is desirable that the Government should be urged to take steps to amend the law with reference to the registration of births and deaths."

The Council approved of this resolution, and the matter has been brought under the notice of the Local Government Board, the Home Office, and the Registrar-General of Births, Deaths, and Marriages.

Resolution passed in the Conference of Medical Officers of Health—

"That the Council of The Royal Sanitary Institute be asked to draw the attention of the leading Agricultural Societies and Show Committees to the necessity of insisting upon a proper standard of cleanliness in all milking competitions with a view of providing the public with cleaner and more wholesome milk."

The Council approved of this resolution, and steps are being taken to bring the matter under the notice of Agricultural Societies and Show Committees.

Resolution passed in the Conference of Sanitary Inspectors—

"That the Council of The Royal Sanitary Institute be asked to make such representations to the Local Government Board as appear to the Council necessary in order to secure an amendment of the Dairies, Cowsheds, and Milkshops Order, on the following points:—

1. The regulation of the sanitary condition of cowsheds, and all premises from which milk is purveyed.
2. The addition of provisions for assuring that milch cows are in healthy condition.
3. The addition of provisions for enforcing personal cleanliness on all persons who are engaged in the milking of cows and the distribution of milk."

The Council did not consider it desirable to take any action upon this at the present time, as it is probable that the subject will be dealt with by legislation in the near future.

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CONFERENCE OF PORT SANITARY AUTHORITIES.

ADDRESS

By COUNCILLOR JOHN UTTING, L.R.C.P., M.R.C.S., J.P.,

Chairman, Port Sanitary Authority, Liverpool.

PRESIDENT OF THE CONFERENCE.

ALTHOUGH Port Sanitary Authorities, as we know them to-day, are comparatively modern, as far as their style and title is concerned, there is no doubt that the functions discharged by them can be traced far back, to the time when in the East measures of isolation were adopted in reference to leprosy. The earliest definite mention of purely port sanitation is to be found in the record of the establishment of an authority in Venice in the year 1348, which consisted of three officers appointed to deal with what was, at that time, even as now, a matter of constant anxiety, the importation of plague, or, as it was designated in those days, black death. In 1403 we learn of the first lazarette in Venice. Those are the earliest records I have been able to discover of definite port sanitary administration. It is interesting to us all here to-day to realise that our functions and our duties are in reality, if not in name, dignified by a fairly high degree of antiquity, and, if time permitted, it would be extremely interesting to trace their history through the centuries succeeding the periods of the first efforts of the Venetians.

There is also another aspect of port sanitation which is both interesting and instructive, and that is its *international character*. In that respect it forms one of the most pertinent illustrations of the cosmopolitan character of true scientific labour. Science belongs to no country, to no nation, to no race; it belongs to all the nations and races of the earth, and

should be always and at all times above those features of exclusiveness and special advantage which characterise the progress of those particular interests of mankind known as commerce. The science of preventive medicine, and particularly that branch of it in which we are at present most interested, when considered in relation to its international character, gives us a striking object-lesson in confirmation of those views. Our esteemed friend and colleague, Sir James Crichton Browne, speaking at a meeting a short time ago, with that remarkable felicity of diction which is so characteristic of his utterances, labelled the port sanitary authorities as the "blue-water" school of sanitarians. I see no reason to object to, or to cavil in any shape or form at, the title, but accepting it in its widest sense I am disposed to regard our port sanitary authorities in the great forces of public health as parallel to our navy in the protection of our riparian cities and their commercial interests against the invasion of infectious disease from abroad. The simile is a good one, but in this instance happily the forces of civilisation are not arrayed one against the other, but are united by a common object, the prosecution of war against those eruptions of Nature which, left unbridled, would cripple our commerce and decimate our population.

Perhaps no subject in the wide field of hygiene has been productive of so great an amount of international consideration as the question of quarantine, in its original sense, both on land and sea. The history of the question, as evidenced by the events relating thereto during the nineteenth century, is full of interest, particularly to British people, from two points of view: first, the character and magnitude of the interests involved, and secondly, the position which has been taken up and held by our representatives at the series of international congresses held during the last century, where their views for many years upon the question of the quarantine laws were very diverse from those held by the representatives of other European States.

As far back as 1849, and again in 1852, Chadwick, Southwood Smith and others were arguing against quarantine in its original sense, and although their arguments were not always based on sound epidemiological principles, there is no doubt that those British representatives of our sanitary authorities laid the foundation of the first movements which were eventually to result in the abandonment of quarantine in its original sense. But it was not until the year 1865 that the real battle against the old methods of quarantine, methods that were costly and productive of enormous difficulties and delays to the shipping of the world, was begun by Sir John Simon, the medical officer to the Privy Council. Since 1852 there have been nine conferences held between the delegates of the Powers

with a view to uniform action in keeping out infection from the East, and preventing its spread in Europe. With the exception of one, that of 1897, all were occupied with the considerations associated with cholera. No result came from the first four conferences, and no conventions resulted in consequence of them, but each of the subsequent five have been followed by international conventions on the part of nearly half of the Powers that were represented. The general effect of those conventions has been the abandonment of the high quarantine doctrine of constructive infection of a ship as coming from a scheduled port, and an approximation to the principles advocated by representatives of Britain for many years. It is notable that all international efforts in the sphere of port sanitation, from the time of the establishment of the Council of Venice down to the present day, have been directed against cholera, plague, and yellow fever. It is really to cholera and plague, and the fear those diseases engendered, that we owe those international congresses and the conventions that have resulted therefrom. It is interesting perhaps to mention that at one time there was another disease that was the subject of consideration by the European Powers, especially those in the north of Europe, and that was the question whether any steps could be taken to limit the spread of syphilis.

I think we may all congratulate ourselves at the present time, that quarantine in its original sense is now a dead letter. It is a thing of the past in the United Kingdom, the principal countries of Europe, and the United States. It is easy for us to imagine under the old regime the cost and the delays of the proceedings associated with quarantine, when vessels were detained on their arrival from infected countries for sometimes from forty to fifty days; in some instances their cargoes entirely destroyed, in many instances damaged by the methods of procedure adopted in reference to their disinfection and purification. It would not be equally easy for us to realise what the result in the present day upon our own commerce would be were those measures, that were adopted under the quarantine laws in their original sense, still in operation. The last occasion upon which in this country there was really an appeal to the quarantine laws in their original sense was at Swansea, your neighbouring port, when a vessel came from Cuba, in the year 1885, laden with ore, and infected with yellow fever. It was in 1865, that Sir John Simon was very active in raising the question of international control, and it was chiefly owing to the expressions of his strong opinions that a scientific inquiry began which ultimately led, step by step, to the almost total abolition of the original practices of quarantine.

Writing at that time, Sir John Simon said: "There are two kinds of

precaution which may be used against quarantine. First, if possible to prevent the entrance of the contagion; secondly, if the contagion be present to annihilate, as far as possible, the circumstances which favour its spread. Subject to one qualification, which is not an important one for the present argument, it may, I think, be accepted as certain that quarantine, conducted with extreme rigour and with the extreme precision of a chemical experiment, would keep cholera out of every port of Europe in which the extremely difficult conditions can be absolutely fulfilled. Thus I have no hesitation in saying that England ought to resist cholera by quarantine. On the other hand, though I cannot pretend to discuss with any kind of authority the non-medical aspects of the question, it would be mere pedantry for me to ignore that facts which are of common notoriety, and considerations which are of common sense, conflict entirely with that purely medical conclusion. The quarantine which is ineffective is a mere irrational derangement of commerce, and a quarantine which ensures success is a great deal more easily imagined than realised."

It was not, however, until 1873 that so far as cholera was concerned quarantine was officially abandoned by order of the Local Government Board, and the following year at one of the international sanitary conferences, held at Vienna, the views of the British representatives prevailed so far that the conference was the first in any form to give sanction to the principle of a Board of medical inspection taking the place of quarantine. No further alteration in the laws occurred until 1885, when another conference was held, this time in Rome, and there, in deference to the advocacy of the British representatives, it was laid down for the first time that it was not necessary to consider articles as infected because they came from countries where cholera prevailed; that only persons who have been suffering from cholera, or articles that have been actually soiled by cholera patients, or clothes that have been worn by persons suffering from the disease, were to be subjected to destruction. At the International Conference, held at Venice in 1892, the question of cholera as sea-borne in relationship to its spread by sea, was solely dealt with.

In all these conferences there was still apparent considerable divergence of opinion between the representatives of England and those of the Continent as to the efficacy of quarantine against the spread of cholera and other infectious diseases. The trend of British opinion, influenced by Sir John Simon through these series of controversies, was to trust to means of sanitary improvement as the best prophylactic against cholera, and to rely upon proper quarantine against cholera in a small degree, whereas, down to 1892, on the Continent the belief in quarantine,

although apparently diminishing, still retained much of its force. It was at the conference held in Dresden in 1893 that the great change in the opinion of Continental sanitarians towards the value of quarantine in its original sense, as compared to general measures of sanitation advocated by Sir John Simon, arose. That conference at Dresden was convened for the purpose of considering the precautions that ought to be adopted on land and sea against cholera, and it was at that conference that the minimum and maximum courses to be adopted were first described, the minimum being obligatory, the maximum optional; and the continental methods of dealing with cholera were then made to correspond closely with those that had been in existence in England for twenty years previously, from 1873. It was at that conference also that the great principle was accepted that precaution must be taken on the accepted basis that cholera is communicated by human agency, and on lines of human intercourse and trade routes. In 1894 another conference was held in Paris for the purpose of devising measures to prevent the spread of cholera by way of the Red Sea and the Persian Gulf. In 1897 the International Conference of Venice assembled to deal with matters connected with the outbreak of plague in the East, and it was at this conference that the most important principle of international notification was unanimously adopted, a principle which in its faithful application I regard as one of the most valuable enactments connected with the question, one which it is impossible to over-value. It is an agreement under which each government notifies all other governments of the existence, at any time at which it may arise, of any plague within its jurisdiction, and at the same time indicates the means which are being carried out to prevent its diffusion.

Without entering into the details of the work of that conference, which would be out of place on this occasion, one need only say that the results indicated a great advance, on the part of the nationalities represented, towards a liberal and scientific conception of the means which ought to be adopted by their respective governments for the prevention and control of infectious disease; and viewed in relationship to the measures that were advocated by our British representatives, I think they constitute one of the greatest tributes that could be paid to our British sanitarians, to their great foresight and wisdom.

But, after all, the great question which concerns us at the present day is this: Are we at present in any danger of invasion by cholera, plague, or yellow fever? To that there can be but one answer, and that is in the affirmative, perhaps with this qualification, that there is very little danger of our getting an invasion from yellow fever, but as far

as cholera and plague are concerned, the danger exists at the present day as in the last century. It is impossible to consider cholera and plague, their history and behaviour, and their method of advancing, as in the case of cholera along the great trade routes of the world, without coming to the conclusion that there is danger, and having regard to the effects associated with the increase, the rapidity and facilities of traffic and intercommunication, and also to the fact that in some instances there may be what are known as ambulatory cases, there can be little doubt that the danger of invasion does exist and will continue to exist.

Arising then from that, the next important question which we have to answer is this: Are the measures that are adopted by our sanitary authorities sufficient to cope with those admitted dangers? With the experience that one has had of port sanitary work in Liverpool, and with the knowledge that one is able to gather from studying the history of the two diseases, cholera and plague, I have no hesitation in taking the view that the measures at present prevailing in this country against those diseases are adequate. All experience goes to show that although cholera and plague are exceedingly difficult diseases to keep out of a country altogether, they are easy to control under good sanitary conditions, and even under moderately good sanitary conditions, provided they are not allowed to establish themselves. Vigilance on the part of medical men, and a high standard of perfection on the part of the administrative sanitary authorities, are of the utmost importance. Backed by them our officially-prescribed measures may be relied upon with confidence to dispose certainly of plague, at all events, quickly and effectively, and that opinion is confirmed by the result of recent experiences in this country when plague or cholera has visited us. The probability is that of the two diseases, the latter is the rather more difficult to deal with; but even there sanitary measures of a general character rigidly carried out prove in several instances their complete efficacy. For example, in 1895 31 vessels arrived infected with cholera at three British ports. From none of these vessels did the disease spread ashore. In 1897 a ship with plague on board arrived in Portsmouth and landed 1,200 troops without infection being conveyed by their dispersal. In all these cases the prescribed rules were rigidly observed and carried out.

The great invasion of Europe by cholera in 1893 provided lessons of the greatest importance in dealing with this disease. It proved that the one real and sufficient precaution is a highly perfected condition of sanitation backed by good vigilant administration. The experience of Great Britain was a remarkable piece of evidence, but that of Berlin

was really more striking, for Berlin lay in the centre of four fires, was in direct and frequent communication with Hamburg, Russia, France, and Austria, and had not the advantage of a sea frontier. During that great epidemic cholera was repeatedly brought into Berlin, but its successful repression was accomplished without any irksome indications. The success of Great Britain and Germany in keeping cholera in check by ordinary sanitary means completed the conversion of all enlightened nations to the policy led by Sir John Simon, and advocated by the representatives of Great Britain at the series of international conferences to which I have made allusion, that is the policy of abandoning quarantine, which Great Britain did in 1873, and trusting to sanitary measures, with medical inspection, of persons arriving from infected ports.

From India, where cholera when it breaks out is perhaps as difficult to deal with as it is in any country in the world, we get illustrations of what efficient sanitary administration is capable of accomplishing. In 1893, at Samarkand, three regiments were encamped side by side on a plain close to a stream of water. The colonel of one of those regiments, who was evidently a most rigid sanitarian, took extraordinary sanitary precautions in view of the prevalence of cholera in the country. He placed a guard over the river, and he compelled his men to use boiled water, even for the purpose of their ablutions. With the other two regiments only the ordinary precautions were adopted. What we as sanitarians would expect is really what happened. The rigid sanitarian preserved the health of his men, and not one case of cholera occurred in the regiment. The other two regiments lost between them 100 men. That is an illustration in support of the opinion one has formed of the reliance which may be placed on high sanitation.

Again, to show how indifferent sanitation may be one of the causes of the spread of cholera, the case of Asterabad may be quoted. At Asterabad, in the same year as the above episode, cholera had almost entirely disappeared from the country, when a Government banquet was given in honour of the Czar's name-day. Of the guests at the banquet half died in twenty-four hours, and within forty-eight hours a terrible outbreak occurred, which carried off 10 per cent. of the population of the district. What had happened? The water supply just above the place where the banquet was held came from a small stream, and immediately before the banquet a heavy rainstorm occurred, which had swept into the stream all the surface water of an infected village higher up the country, and some considerable distance from the banks. The neglect of the ordinary sanitary precautions regarding that drinking water was really the cause of that visitation.

But the classical example of Hamburg is perhaps more convincing than any other. The water supply of Hamburg is obtained from the Elbe. The drainage from the town also runs into the river, and the movement of the tide was sufficient to carry the sewage water up above the intake of the waterworks. Before this water was consumed it had to pass through a couple of ponds to act as settling tanks, which were inefficient, and in short, the water supply of Hamburg was lamentably bad. This was the state in 1892 when the epidemic of cholera infected that place. On the other hand, at Altona, which is continuous with Hamburg, there was a separate water supply, the conditions of which were fairly good. Now in all other respects, excepting water supply, the conditions of sanitation, the character of the population, their employment, and so on, of Hamburg and Altona, were practically identical. What happened? In that epidemic 8,605 people died in Hamburg, and only 300 in Altona. A remarkable fact is to be noted in reference to that episode, and it is this. In some of the streets one side of the street lies in Hamburg and the other side of the street is in Altona, and at those streets the spread of cholera stopped. They constituted a dividing line, the Hamburg side of the street being full of it, the Altona side escaping. Here we have a striking illustration of the terrible results which may accrue from neglecting one of the most if not the most important of all sanitary conditions, a pure water supply. It will, we hope, be impossible ever to witness such an occurrence again. But for the point that we have in view it is sufficient to say it is a most powerful and striking illustration of the influence which genuine sanitation exercises on the progress of these diseases.

There are other illustrations. Take Grimsby, for instance. We find a lesson there that, in spite of pure water, if other measures of sanitation are neglected, disaster may follow. It was there that cholera obtained a decided hold, in spite of a pure water supply, through the fouling of the soil by cesspools and defective drainage. So, also, at Havre at the same time. Further, it was conclusively proved at Grimsby that cholera can be spread by sewer-fed shell-fish. Several of the local outbreaks in England at that time were traced to the ingestion of oysters obtained from Grimsby beds. In short, it may be said that all unhealthy conditions favour the prevalence and spread of cholera, in some degree, at all events.

Perhaps no public reference of the character of this paper would be complete on this subject unless we made some allusion to the regulations of the Local Government Board, issued on the 9th September last,

regarding cholera, yellow fever, and plague. It is pointed out in those regulations that the majority of the provisions contained therein are merely reproductions of those formerly issued. Although they don't apply to Liverpool and some other ports, I have been unable to detect anything in them which differs materially from the precautions and measures which we have for some time past adopted in Liverpool in dealing with the diseases under consideration. I observe, however, that there is a clear definition of the terms "suspected ships" and "infected ships." The term "infected ship" is limited to a ship on which there is actually on board, at the time of arrival, a case of cholera, yellow fever, or plague, or in which there has been a case within seven days before arrival; or in the case of yellow fever, eighteen days. The term "suspected ship" is used as applying to a ship on which there has been a case of cholera or plague more than seven days before the arrival of the ship, or a case of yellow fever more than eighteen days before the arrival; whether the case has occurred in the port of departure or another port in the course of the voyage, or at any time during the voyage, or on which no fresh case of cholera or plague has occurred within the seven days, or of yellow fever within the eighteen days.

In dealing with the precautions for the prevention of the spread of plague under those regulations, the question of the destruction of rats inevitably arises. It is impossible for us to overlook the conclusions of the Indian Commission on the subject of bubonic plague in man, those conclusions being that it is entirely dependent upon disease in a rat, and that infection is conveyed from rat to rat, and from rat to man, and from man to man, solely by means of fleas.

A further conclusion of that commission is that a case of bubonic plague in man is not in itself infectious, but entirely dependent upon a rat and a flea agency. Bearing these conclusions in mind, it is rather difficult to arrive at a satisfactory explanation as to why, in those regulations, it is not made obligatory to destroy all rats in a suspected ship, equally as in an infected ship. In the Memorandum, it is appointed by Articles 23 and 24, regarding the procedure to be followed in cases of plague, that it is only in an infected ship that the destruction of rats is compulsory. I think it ought to be equally compulsory in suspected ships. At all events, the practice that has prevailed in Liverpool for some time past is to destroy all the rats on any ship where there has been plague, or on any ship which has come from any plague-infected ports, or touched at any ports in the course of the voyage where plague is known to exist. Not only are the rats in each instance of that character caught, but they

are all subjected to bacteriological examination, in order to secure the greatest amount of information relative to the possibility of plague existing unknown or unrecognised in any such vessels.

We have not, at the present day, any anxiety arising relative to the ordinary zymotics when they arrive here from a foreign country in a ship; and I have confidence that, given proper means of isolation, a rigid application of powers which we as sanitary authorities possess, an intelligent vigilance on the part of our officials, an accurate administration of all our regulations and rules, and a faithful adherence on the part of masters of vessels and of all those upon whom devolves the duty of giving information, we shall be able to look to the three diseases, cholera, yellow fever, and plague, which have so long exercised the minds of various international commissions and our leading European sanitarians, as being in the same category with reference to port sanitary administration as the ordinary zymotic diseases.

I scarcely like to close my address to you to-day without making reference to the new duty which is imposed upon our authorities under the "Public Health Regulations as to Food Act," passed last year, which gives the Local Government Board power to make regulations under the Public Health Act, 1898, to prevent danger arising to the public health from the importation, preparation, storage and distribution of articles of food and drink (other than drugs or water) intended for human consumption. Such regulations may provide (1) for the examination and taking of samples of any such articles; (2) for the recovery of any charges authorised to be made by the regulations for the purpose of the regulations, or any service performed thereunder, and may apply as respects any matters to be dealt with by the regulations any provision in any Act of Parliament dealing with the like matters, with the necessary modifications and adaptations.

I venture to hope that, in carrying out the inspection of food and meat provided for by this Bill, uniformity of method may prevail in the various ports of the country as nearly as possible, and that in the execution of the duties assigned to us by the regulations of the Local Government Board thereupon, we shall endeavour to carry out our administration in such a manner as to avoid any proceedings of an arbitrary character, or of such a nature as may prove irksome to the commercial interests of the various ports, or at least to those sections of such interests as are represented by the persons who import our food-stuffs. When one considers the immense value of food-material that is brought into this country annually, one cannot fail to be impressed with the magnitude of the task which devolves upon port sanitary authorities with reference to this Act.

It may be observed that although there has been no obligation in regard to this in the past, with the exception of London, which has had a special Act bearing on the matter since 1891, and in Manchester since 1906, still in the other ports of the country there has been a great deal of valuable and effective inspection carried on by port sanitary authorities. This work has been only possible by a mutual co-operation of port sanitary authorities and the consignees or consignors of material which has deteriorated. And arising from this aspect of the question one may observe that it is probable that before long a recognition will arise of the mutual interests of health authorities, consignees and consignors, in reference to this question. It can never be to the true interests of either of the latter two interests that any food-stuffs which are unsound or detrimental to the public health should be diffused throughout the country, and hence it will be to the interests of consignees and consignors that this inspection should be made as complete as possible.

I therefore venture to express the opinion that we shall find, as we proceed with the administration of this Act, that we shall obtain every assistance from the parties concerned, and when its scope and its objects are fully realised, they will heartily co-operate with the port sanitary authorities in making inspection as effective and as beneficial to the community as possible. It must always be borne in mind that this inspection of food upon landing is not meant to supplant existing methods of dealing with unwholesome food, wherever discovered and offered for sale, but it is supplemental to existing measures, and it will surely be recognised that it is infinitely less dangerous to the community to detect and arrest unsound articles of food intended for human consumption on their landing, and no longer allow them, as heretofore, to be diffused throughout the country and exposed for sale before any steps can be taken regarding them.

The draft regulations of the Local Government Board bearing upon this question are scarcely so definite as I hoped they might be. It will be observed that, so far as the unsound food regulations are concerned, they appear to be purely optional. Article IV. of those regulations, dealing with the powers of medical officers of health in relation to unsound food, directs that such officers *may* examine an article of food which has been landed within the district, and throughout those regulations the permissive word *may* dominates the question. It is not for me to criticise the wisdom of the Local Government Board in framing those regulations, but in view of the opinion expressed concerning uniformity of administration in the various ports, it is easy to realise that under these regulations port sanitary authorities may materially differ in their appli-

cation of the powers conferred upon them, and that in some instances a desire to place the commercial interest of a port (as distinguished from the interests of public health) in the forefront, may lead to a milder application of those powers than is exercised in rival ports. I observe, however, that these regulations may be cited as The Public Health (First Series: Unsound Food) Regulations. Perhaps a further series may take into consideration the advisability of making inspection of food obligatory.

The regulations dealing with foreign meat are, in my opinion, much stronger and better defined: providing, as they do, in certain classes of foreign meat, for obligatory inspection. Certainly there exists less likelihood of difference of administration under these regulations than those drafted as applying to the inspection of food other than meat.

There are questions arising upon Article III. of those regulations that call for consideration. I think the question will arise as to whether some of the functions entrusted to the Customs officers under that article would not be safer in the hands of a qualified inspector, unless, indeed, the Commissioners of Customs contemplate the appointment of a specially-trained officer for this work, who will act under the direction of the authorities who administer the Act: but I would take this opportunity to acknowledge the extremely valuable and willing services rendered generally by every officer of the Customs Staff to Port Sanitary Authorities.

It certainly appears to me that it would have been more rational to have limited Article III. to its first clause with the addition thereto of a direction that the medical officer should be notified if the cargo of a ship comprises any foreign meat, leaving the subsequent steps to be carried out by properly trained and qualified inspectors.

Taking the regulations as a whole (with the exceptions I have named), I agree generally with the methods and measures prescribed.

There is another question which is worthy of the consideration of port sanitary authorities, and that is the cost of administering this Act. Ought it to be borne entirely by the individual port sanitary authorities, or should it not be defrayed, at least in part, by the Imperial exchequer? The benefits conferred are so distinctly national that it seems scarcely fair to the ports that they should be saddled with the whole expenses. I hope that those port sanitary authorities which are represented here to-day will take action in the matter, and bring the question before that very useful body, the Association of Port Sanitary Authorities, at an early meeting.

THE SANITATION OF MODERN PASSENGER SHIPS.

By F. M. WILLIAMS, M.R.C.S., L.M., D.P.H.,
Medical Officer of Health, Borough and Port of Plymouth.

TO the inhabitants of a sea-girt country, such as England, a ship must ever be an object of interest and admiration, whether regarded as the substitute, the more than substitute, for stone walls as a defence, or as a channel whereby commerce is carried on with foreign countries. As a work of art, too, a ship has at all times and in nearly all countries called forth expressions of wonder.

Sanitation, as applied to cities, towns, or villages, may be summed up in: The rapid removal and disposal of filth, and the ample supply of pure drinking water. I do not suggest that this is the whole of sanitation, but I think it will be comprehensive enough for my purpose. Sanitation of the modern passenger ship includes other questions; especially lighting and ventilation.

On board ship there is no difficulty in the rapid removal of filth, and no complicated system of drainage or sewerage is required. The question of ventilation is a much more difficult one, and of late years this has been very greatly improved.

The water supply is a matter only of mechanical application and storage room, and as the headquarters of most of the big companies are in cities that have excellent and pure supplies, no trouble is likely to arise in this way. The introduction of electricity for lighting purposes has done much to improve the condition of the air in cabins. There has been a general tendency to considerably increase the cubic space for passengers and for crew, and legislation has considerably increased the crew space, the requirement, which was formerly 72 cubic feet, being now 120.

A great deal of thought and care has been exercised in the internal arrangements of vessels engaged in the Atlantic trade, as also in those lines running through the tropics to the east. I have taken, for the purpose of discussion, two well-known companies, the Peninsular and Oriental, trading to the east, and the Cunard vessels engaged in the Atlantic service.

The necessities of the two companies are vastly different. In vessels the greater part of whose voyage is through the tropics, the chief object for the comfort and well-being of the passengers has been to provide free natural and mechanical ventilation and protection from the sun. On the other hand, in those vessels crossing the Atlantic, especially in winter, everything has been done to get the interior temperature comfortable, and to provide ample ventilation by warm air by mechanical means; in both cases I think the designers have well succeeded in this matter.

I propose to deal with the eastern-bound ships first.

We may take it for practical purposes that a big modern passenger ship represents, in the way of population, a big village or even a small country town, as you are probably aware that the full complement of passengers and crew of one of these ships is between two and three thousand, the length of such vessels being anything from 500 to between 700 and 800 feet, 30 to 80 feet beam, with a depth of from 30 to 50 feet. Under these conditions one at once realises the difficulty of ventilation.

The water supply is merely a question of storage. The lighting and heating are also simple matters.

Ventilation.—The proper renewal of the air, in east-bound ships, is obtained by the use of electric fans in the saloons, smoking and music rooms, lounges, and in the passengers' cabins. In addition there are numerous shafts for ventilating purposes, and wherever possible open skylights. Compared with ships of a former day, there is no difference in this matter, apart from the size of the ships, except that electric fans now supplement the other methods, and in fact largely supplant them.

As the company's ships have always been fitted for tropical work, the natural ventilation has always been a prominent feature in construction.

Heating.—An extensive system of steam-pipes provides the heat necessary for warming the ship when in cold latitudes. In the old days, open fireplaces in the saloons, etc., was the method in general use.

Lighting.—Electric light is now universal, in place of oil lamps, and at a still earlier date, candles.

Crew's Quarters.—With the increase in the size of ships, and the improved arrangements, the space allotted to the crew, both native and European, has become considerably enlarged. The natives are housed on the upper poop deck, whereas in past times they were on the lower forecastle, and in addition, in all the modern ships, a very large covered-in deck space is now available for the native crew. The cubic space allotted to the crew and passengers is greatly in excess of the minimum required by the Board of Trade.

Storage of Food and Water.—The refrigerating chamber has, of course,

worked a revolution in the storage of food. The ships belonging to the P. & O. are all supplied with the latest improved type of refrigerating plant, and the preservation of food is much simplified. Before this, live-stock was carried.

The company's ships are planned to work successfully in the tropics, and whereas, in the old days, passengers had to be frequently battened down during bad weather, such a thing is now unknown, on account of the cabin accommodation being built high up.

Bathrooms and lavatories are plentiful, and the water-closets are all built on the open plumbing system. The soil-pipe is trapped both at the pan and at the end opening into the sea.

Water for drinking purposes is stored in tanks and is passed through filters before reaching the consumer.

Medical Arrangements.—With the march of progress in sanitation, and the demand on the part of the public for increased facilities for medical treatment, the accommodation for those who are sick has from time to time been improved, and on all the ships belonging to the company, cabins are set apart for those who have contracted infectious diseases, or who require to be separated from others. In the newest boats the cabins are fitted with all appliances that are necessary to treat disease, and all ships carry a surgeon and a scale of drugs far in excess of what is laid down by the Board of Trade. In addition to the hospital cabins there is, on all ships, a surgery in close proximity to the surgeon's cabin. Many vessels are also provided with steam disinfecting chambers.

Ventilation.—The Cunard Company has adopted the thermo-tank system of ventilation on the two latest additions to their fleet. This system aims specially at insuring to all the living quarters of the ship a continuous supply of fresh air, which is not only warmed to the requisite degree, but is humidified so that none of the bad effects of over drying can be felt. In cold weather the warmed air is discharged through a regulated louvre into each compartment, near the level of the ceiling; as it cools it gradually sinks to a lower level, carrying with it any carbonic acid gas, to the passage ways, where means are provided for allowing it to pass outside. In warm weather, or when heating is not necessary, the reverse action takes place, as the louvres near the ceiling constitute the exhaust, with the result that the warm impure gases leave at the top of the room, and fresh atmospheric air comes in at the floor level.

These thermo-tanks, the manufacturers state, are capable of changing the air, either by exhaust or supply, at least from six to eight times per hour, and they are also capable of maintaining a temperature of at least 65 degrees Fahr. in the coldest weather. In addition they are inter-

connected, so that in the case of the breakdown of any thermo-tank a supply can always be obtained from another.

The thermo-tank system, as introduced by the Thermo-tank Ventilating Company, of Glasgow, generally consists of an electric motor operating a fan which discharges air to the outside of a tube heater. The air then passes through the tubes, and comes in close contact with the heater surface, flowing thence to the main distributing trunks. Two valves are used for controlling the passage of air; one for regulating the temperature, while the mushroom valve on the top is provided for the exhaust air. It will be noted that the air passes round the outside of the heater on its way to the tubes, so that the loss from radiation is very small, the outer casing of the thermo-tank being always cool.

The heater is warmed by steam from the main boilers, entering at the top, with an exhaust at the bottom. The pressure of steam is reduced to about 30 lbs., and a relief valve is fitted to blow off at from 80 to 100 lbs. pressure. The heater and all its connections are tested to the full boiler pressure. The air is humidified by means of a special valve admitting steam in a fine spray, through small needle-holes in a copper hoop surrounding the heater. There are 65 of these machines fixed in different parts of the ship, and the whole time of two engineers is devoted to them.

The work of the thermo-tanks is further augmented by means of twelve powerful exhaust fans, which are connected by means of trunks respectively to all the galleys and pantries, bathrooms, lavatories, and water-closets, these fans being of sufficient capacity to change the air in the above-mentioned compartments at least fifteen times per hour.

In addition to the living quarters, the holds and other compartments, forward and aft, are also mechanically ventilated, so that all natural ventilation requiring cowl-heads, or openings through decks, has been dispensed with.

Bathrooms and Lavatory Accommodation.—The accommodation on the Lusitania and Mauretania is very complete and up-to-date. A few details of the various fittings may be of interest.

The closets in the first and second class are of the wash-down type, but the outlet is flanged, and is six inches or eight inches above the deck. Attached to this outlet is a white-metal box, which encloses the valve, Doulton's patent storm valve. This allows a clear discharge of the contents of the pan, while the valve prevents back flow. It is also accessible for repair without removing the closet. The closet has, therefore, the cleanliness of the wash-down, with a deep seal to the pan, in addition to the advantages of the single valve pattern.

For the third class passengers a door action is used. The valve is made on the same principle as for the first and second class, but is actuated by the opening of the door. The closet is flushed when the door is opened on entrance, and again when the user leaves.

The urinals are of the latest circular-backed pattern, the backs being semi-circular, so shaped with a returned rim that neither urine nor water can come in contact with any joints. The bases discharge into a channel which is covered by a white-metal hinged grating. The divisions are in marble, varying according to class. Each range is flushed by an automatic tank connected to spreaders, which cleanse the backs. A separate pipe is carried from the tank to a sparge pipe above the channel, so that every part that may be soiled is cleansed automatically.

The baths are of cast iron, enamelled inside and out with white vitreous porcelain. Each first-class bath has a white-metal spray with showers. Each fitting is governed by a Doulton patent mixing valve, by means of which the water can be regulated to any temperature by a slight movement of the lever. Cold must be turned on first, which prevents scalding. The supply to the bath enters at the bottom, thus avoiding steam, and is noiseless. A thermometer is fixed to each valve, so that the bather can at once see the temperature. The baths for the other classes of passengers and for crew are of the same material, the only difference being in the size and fittings, some being without showers.

Storage of Food and Water.—The steward's store rooms on the Lusitania have a cubic capacity of 25,000 feet. They are divided into various compartments, such as beef house, mutton and poultry shop, stores for fruit and vegetables, groceries, flour, wine, and spirits, etc., all convenient to the kitchen, which extends across the full width of the ship on the main saloon deck.

Water for drinking purposes is stored in tanks, and is filtered before reaching the consumer. The fresh water capacity of the latest Cunarders is very large, the tanks for drinking purposes containing 250 tons, the remainder of the fresh water being carried in the double bottom, the ship usually having over 2,000 tons on board when leaving port.

Passenger Accommodation.—Not many of the present generation have reading and imagination enough to contrast the sea life of to-day with that which was suffered a century ago or more. Now-a-days it is a real pleasure to travel by sea, in days long since it was a dread.

The first and second-class passengers are berthed in two and four-berth rooms, which are exceedingly spacious, varying from 8 ft. by 8 ft. to 12 ft. 6 in. by 10 ft., with a height of 10 ft. in rooms on the D deck.

Arrangements have been made to connect water-closets and baths with a large number of the state-rooms, and in this respect the Lusitania and Mauretania are unexcelled. Third-class passengers are berthed on the upper passenger deck, the space amounting to 11,669 sq. ft., with an average height of 8·7 ft. = 101,520 cubic ft., or 778 adults at 15 sq. ft. each. In this space only 622 persons are berthed in rooms of two and four berths.

On the lower passenger deck the berthing space amounts to 9,816 sq. ft., with an average height of 7·8 ft. = 76·54 cubic ft., or 546 adults at 18 sq. ft. each person. In this space 520 persons are berthed in rooms of two and four berths. Each third class state-room is fitted with wash basin and there are a large number of baths.

Lighting.—On the Lusitania there are about 6,300 lamps, mostly of 15-candle power.

Apart from the very complete system of artificial ventilation and heating of all parts of the ship, electricity is also applied in the ventilation of the engine room, electric motors and electric heaters are very extensively in use in connection with the galleys and pantries, there being 41 different machines or heaters in operation, performing such various duties as dough-making, dish washing, ice-cream freezing, knife and boot cleaning, potato peeling, beef and bird roasting.

The following is the hospital accommodation on the Lusitania:—

For *Men.*—2 wards, 223 sq. ft. area; 4 beds in each ward; bath and w.c., 46 sq. ft. For *Women.*—2 wards, 217 sq. ft. area; 4 beds in each ward; bath and w.c., 52 sq. ft.; height, 8 ft. 8 in. *Infectious Diseases Hospital.*—1 ward, 58 sq. ft. area, 4 beds; 1 ward, 52 sq. ft. area, 2 beds; bath and w.c., 30 sq. ft. *Dispensary.*—8 ft. × 8 ft. 5 in. = 68 sq. feet.

To me a huge modern vessel seems to be the finest specimen of man's brain, power, and handicraft. We only have for a moment to think that, however the winter gales of the North Atlantic and the huge Atlantic seas hammer and thrash, or the monsoon, the cyclone, or the typhoon of tropic seas hurl their forces against the vessel, she still holds her way through it all, rarely more than a few hours late. The administration of the floating town goes on with the regularity, comfort, and safety of a huge modern hotel, rarely is a meal disturbed.

In conclusion let me express my thanks to the P. & O. and Cunard Companies for their courtesy and for the enormous amount of particulars afforded me in reference to their vessels, particulars which it would be impossible to introduce within the scope of this paper.

[*For Discussion on this paper, see page 678.*]

SANITATION AFLOAT.

By D. JENKINS, Cert.R.San.I.,
Chief Inspector, Cardiff Port Sanitary Authority.

THE sanitary authorities of the principal ports in this country, and also of some of the ports on the Continent of Europe, are now paying a great deal of attention to this matter.

It is only of late years that anything in the way of ship inspection has been carried out by those responsible for the administration of the public health in this respect, and it is most gratifying to find that a great deal of improvement has taken place in connection with the sanitary condition of our floating population: and, indeed, it is but right that these men should receive special attention, and be made as comfortable as possible whilst performing their duties at sea, which are of an arduous nature, through the constant changes in the climates which they have to pass through, and other hardships too numerous to mention on an occasion of this sort.

The duties of the sanitary inspector are laid down in the General Orders of the Local Government Board, of the 19th July, 1883. The following being a summary as defined in Article 13 of Section IV.

He shall by inspection of the shipping in the district keep himself informed in respect of the nuisances existing therein that require abatement under the Public Health Act, 1875; of the breach of any by-laws or regulations made by the port sanitary authority for the suppression of nuisances. He shall give immediate notice to the medical officer of health of the occurrence of any infectious or epidemic diseases on the arrival of any ship or vessel having such disease on board, and also inform him of any nuisance injurious to health, and of any overcrowding in a vessel, and be subject in all respects to the instructions of the medical officer of health in all matters relating to any dangerous infectious or epidemic disease. He shall also keep a systematic record of the sanitary condition of each of the ships in his district, and of any action taken by him under the Sanitary Acts.

The difficulties which the port inspector has to contend with in the performance of his duties are manifold, and require a great deal of discretion and persuasion, owing to the constant and rapid movements of

ships from port to port, and the inadequate means provided by the Public Health Acts for dealing promptly and efficiently with nuisances and sanitary defects on board ships. In this respect our brother officers in urban and rural districts have the advantage over us; it matters not what time it takes to go through the formalities of obtaining an official order from the committee, the house can always be found, but this is not the case with ships, which are constantly on the move. Section 94 of the Public Health Act, 1875, should be amended, and power be given to the inspector (with the consent of the medical officer of health) to serve official notice, and take legal proceedings in default of compliance, instead of having sometimes to wait a month or more before obtaining the consent of the committee. There are numerous sections in the Public Health Acts relating to port sanitary administration, but the principal ones which relate to nuisances are Sections 91 to 111 of the principal Act (both inclusive) and Sec. 2 of the Public Health (Ships, &c.) Act, 1885.

The chief defects found on board ships are defective and leaky side-ports and prisms, bulkheads, floors, hawse pipes and cable casings, defective stoves, funnels and flanges, ventilators and ventilation, lighting and drainage, leaky decks, defective or unlined iron decks over bunks, defective lamps, water tanks and casks, also defective and insufficient closet accommodation. In addition to the defects enumerated above, the nuisances are numerous and of various character, such as dirty and often dilapidated crew-spaces, which should receive the special attention of some person in authority on board, otherwise these places are often allowed to get into a filthy condition; they should be periodically cleansed, painted or limewashed, and well flushed with fresh air by means of the ventilators and side scuttles. Ship's stores, such as paints, oils, etc., should on no account be kept in the living spaces of the crew, or in lockers adjoining and ventilating into the same. Direct communication between the crew spaces and water-closets should be abolished, and the latter removed as far as possible from all living spaces, with doors opening out on deck, instead of in the alleyways as is often found, with no proper means of light and ventilation. When men are berthed under the top-gallant forecastle, or poop, suitable drainage should be provided by means of lead pipes from the forecastles and adjoining berths, leading out on deck through the water-closets.

The old system of drainage in lower forecastles leading to the bilges has been abolished by the Board of Trade. Wooden bulkheads which separate the closets from the crew spaces should be double, with felt between. Hawse pipes and cable casings leading through top-gallant or

lower forecastles are also a source of nuisance and cause for complaint, owing to the continual use of the anchors and chains these become leaky, and we often find the foremost bunks built around these iron pipes, the consequence is that the occupants thereof suffer more or less from damp beds, owing to leakage or moisture.

Moisture or condensation on iron-work in crew spaces must be very injurious. The Board of Trade requirements in connection with the lining or sheathing of iron-work are very limited; only that portion immediately over the bunks underneath or on top of the iron deck need be covered over with wood. The protection from heat in warm weather, and from moisture in cold weather, thus provided, is inadequate; the whole of the iron-work should either be lined with wood, or covered over with granulated cork, so that all dampness arising may be absorbed. Opinions differ in these matters, some say that if the crew spaces were always well ventilated, no condensation would take place. This may be so when a vessel is in port, but it is not practicable at sea in rough weather. Other nuisances are caused where openings into the forepeak or lazarette are in the crew spaces, and from foul accumulations deposited in various parts of the ship, mostly in the alleyways, and in close proximity to the officers' and engineers' quarters; also from foul and offensive bilges, and unless particular attention is paid to these they become a source of great nuisance, especially in the case of grain ships. If the limber boards are not tight, grain will find its way into the bilges, which invariably contain a quantity of salt water, and with the rolling of the ship the grain and water get mixed, and thus cause a most noxious fermentation. The same thing also applies to the engine-room, but instead of the bilges therein being charged with grain, they are more or less receptacles for grease and oil, which require to be constantly cleansed and disinfected with a solution of carbolic acid. The sanitary condition of our modern ships is superior to that of days gone by; yet there is room for improvement. Men had to eat, sleep, and wash in a place almost devoid of light and ventilation: their bunks often used as a wardrobe and larder, and the maximum air-space allowed by the Board of Trade for each person being only 72 cubic feet, whereas on shore we consider 250 or 300 cubic feet inadequate.

Thanks to the Legislature, the crew spaces in all new ships have been increased to 120 cubic feet per man, with improved ventilation and lighting; and provision has been made for food lockers, mess-rooms, bath-rooms, and steam heaters or stoves for warming purposes. Improvements are made in closet accommodation, troughs being fitted in most vessels carrying large crews, and in some cases these are automatically flushed

from the engine-room; by these means nuisances are greatly reduced, otherwise they become very offensive, especially when they are close to the living spaces. All closets should be removed as far as possible from these places. In sailing ships, deck houses should, as far as practicable, replace lower forecastle, and in the case of steamships the crew should be berthed in the after-part of the vessel, commonly called the poop. The benefits derived in having the crew's quarters fitted up in these places are numerous, not only from a sanitary point of view, but the advantages are great in cases of collision. Tanks and casks containing water for drinking and domestic purposes should receive careful attention; over fifty per cent. of the samples taken from ships at this port and sent to the Public Health Laboratory for bacteriological examination and analysis proved to be contaminated. Section 70 of the Public Health Act, 1875, does not apply to ships, but in this port power is given to the Medical Officer of Health, under the Corporation Act of 1894, Sec. 75, to cause any tank, cask, or other receptacle in any ship or vessel containing water for drinking or domestic purposes, to be emptied and cleansed, if he is satisfied that the same is so polluted as to be injurious to health.

I am of opinion that if power were given to Port Sanitary Authorities whereby all crew spaces and sanitary arrangements on board all new ships were under their supervision during construction, a great deal of improvement could be carried out at first cost, and not as at present, after construction, when defects have been found, giving rise to the complaints of those who have to make the ships their homes.

[*This Discussion applies also to the Paper by* Dr. F. M. Williams, *page 669.*]

Dr. Herbert Williams (Port of London) said that the papers represented—

1. What could be done. 2. What was the actual state of affairs on small steamers.

He emphasised the importance of co-operation between port sanitary authorities, especially as owing to the constant movement of ships it was not possible to get defects remedied, and so it had been the practice to report the defect to the medical officer of health of the port to which the vessel was proceeding.

A description was given of the unhealthy condition of crews' closets on ship board. The want of cleanliness in forecastles was not to be wondered at when it was remembered that they were in constant occupation, and that it was no one's duty to cleanse them.

Refrigerating chambers on board passenger ships should be regularly examined; unsound meat had been found in many instances.

Attention was drawn to the practice of persons suffering from tuberculosis going on board ships and being placed in a cabin with healthy persons.

The crew's space should be under supervision by the sanitary authority at the time of construction; instances were given of serious defects on new vessels which had passed the Board of Trade.

Mr. H. A. Garrett (Torquay) expressed his appreciation of the very practical hints given by Mr. Jenkins. He called attention to the need of urban sanitary authorities treating the subject of inspection with greater seriousness in small harbours on coast towns, which were the resort of small sailing vessels and tramp steamers. He hoped the result of the recent inquiries by the Board of Trade would lead to the compulsory appointment of qualified men who understood sanitation of ships.

Dr. W. F. Dearden (Manchester) said he thought the two papers exhibited an excellent contrast, which gave great opportunities for thought and consideration. If large passenger vessels were built on sanitary lines, cargo boats and smaller vessels generally should be also. Both classes were built under the same set of requirements issued by the Board of Trade. Self interest, of course, insured good sanitation of passenger vessels; they must be salubrious to succeed in these days of competition. This did not obtain as an incentive with other classes. He thought that the Board of Trade surveyor should be more insistent in seeing that sanitary requirements were complied with.

Dr. W. C. Hossack (Calcutta) said that he would like to draw attention to the special considerations that arise in connection with the sanitation of ships in the tropics, particularly with reference to three points, ventilation, hospital cabins, and protection of living quarters from heat. The first two in connection with first class passenger ships, the latter in connection with tramps. The ventilation of the big liner was, in ordinary weather at sea, most satisfactory, but in port and in rough weather when the hatches had to be closed down, required improvement. The electric fans which were used were part of no organised system. They were fixed haphazard, and served rather to circulate the air in cabins than to propel it in any definite direction. In other words, ventilation required to be more systematised.

Cabin Hospitals.—Every first class passenger steamer ought to be compelled by the Board of Trade to provide a properly fitted hospital cabin with a central bed, with access on all sides for purposes of operation. At present, even on high class ships, patients in the last stage of malaria, dysentery, and liver abscess

were put into ordinary bunks in ordinary cabins. It must be borne in mind that such patients were not the rare exception but rather the rule.

Necessity for woodsheathing.—The crews' quarters on the big liners were admirable, but on tramp steamers not built specially for the tropics, conditions might at times be almost intolerable. To cross the iron decks and enter an iron forecastle at midday, when the temperature was 100° in the shade, was an ordeal which must be experienced to be realised. The only marvel was that cases of heat stroke were not more common than they were.

Mr. W. J. Hopkins (Barry) spoke of the supervision of the Board of Trade, and contended that the regulations of the Board of Trade were made but not carried out. The regulations relating to lighting in forecastles were that should one-third of the light be blotted out, it should be possible to read a newspaper in any part of the forecastle.

Further the regulations provided that two ventilators should be provided in every forecastle. This was not done, the Board of Trade holding that one ventilator and a hole cut in the bulkhead to the adjoining room were sufficient.

He was of opinion that the Board of Trade should exercise more supervision in these matters.

Dr. F. M. Williams (Plymouth) said that in their experience in Plymouth, sanitary defects in vessels were chiefly caused by faulty administration on shipboard, the same as the experience of Liverpool.

FOOD INSPECTION AT PORTS OF ENTRY.

By W. F. DEARDEN, M.R.C.S., L.R.C.P., D.P.H.,
Medical Officer of Health, Port of Manchester.

AFTER hanging fire during two sessions of Parliament, a Bill with the direct object of assigning to all Port Sanitary Authorities in England and Wales the duty of inspecting imported food stuffs received the Royal Assent in September last. This Act provides that the inspection of food shall be governed by regulations to be issued by the Local Government Board. A few weeks ago I received a draft copy of these Regulations, and as the whole work of food inspection will be regulated by them in their final form, the proper course to pursue will be to consider, from our own point of view as representatives of Port Sanitary Authorities, how they will be likely to fulfil their object.

Should anyone want to find justification for the inspection of foodstuffs at the Port of Entry into the United Kingdom, he can readily find this by examining the "Annual Statement of Trade," published by the Board of Trade. The returns for 1907 are not yet available, but those that are available are sufficient for the purpose. The value of foreign foods imported during 1906 was, in round figures, assessed at £200,000,000, and that this amount has not reached finality is shown by the fact that in five years the value has increased by about £30,000,000. The value of food stuffs brought into the principal ports in England and Wales during 1906, was as follows:—

London ...	£72,702,835	Southampton	£7,252,985
Liverpool ...	52,415,178	Manchester	5,634,009
Hull ...	17,429,305	Newcastle ...	5,235,078
Harwich ...	8,824,483	Grimsby ...	3,868,395
Bristol ...	8,367,360	Cardiff ...	2,303,355

It is, therefore, apparent that we are dependent upon foreign countries for our means of subsistence, and surely this has now reached a sufficient pitch for us to take in hand means of insuring to the public

that such food is of a proper quality, and free from risk of communicating disease.

Up to the year 1906, the sanitary authority of the Port of London was the only Port authority which had power to inspect these imports, and the gain to the public by the exercise of this power has been amply shown in the Annual Reports of Dr. H. Williams, the Medical Officer of Health. In this same year, the Manchester Port Order was amended by giving power to make these inspections, and the work was commenced in March of last year. Shortly after the Local Government Board inquiry, on the Manchester application, had been held, the "Jungle" scandal in America was brought prominently before the public, and there is no doubt that this made our application more secure, during the subsequent fight which took place in Parliament. But hostility to the Manchester Order was not founded on any objection to a system of food inspection at the port of entry, the contention being that Manchester should not be singled out for these powers when all other ports, excepting London, were open for any class of goods to be brought in. Although this argument was not held to be sufficient reason for refusing the Manchester application, the justice of it, so far as other ports were concerned, was recognised, with the result that the "Public Health (Regulations as to Food) Act, 1907," was pushed through in due course.

Although the amount of food stuffs imported into Manchester is small compared with that brought into the port of London, the first year's administration of food inspection shewed the results to be on exactly the same lines as at the larger port. During this period 260 tons of food stuffs of many kinds were condemned as unfit, and from my experience of the condition of the articles in question, I can safely say that the public have very much benefited thereby.

In dealing with the draft Regulations issued by the Local Government Board, I have thought it would be best to discuss them from the point of view of past experience in supervising food inspection, and to shew the manner in which they will modify present procedure. By their Order the Manchester Port Authority administer the food clauses of the Public Health Act of 1875, and the Amendment Act of 1890, but as power was given in the Order itself to inspect articles of food "on a ship, or brought by a ship within the Authority's jurisdiction," it has been shewn, through a test case, that we have in addition definite power over goods in transit. To the Port of London Authority was assigned the food clauses of the Public Health (London) Act, which, in addition to ordinary powers, enables prosecutions to be taken in the case of goods deposited for the

purpose of sale or of preparation of sale. Apart from the effect which the difference in powers must necessarily have, the mode of procedure at the ports of London and Manchester can be taken as practically the same.

The Local Government Board has published two sets of draft Regulations, one concerned with general food inspection, and the other with inspection of foreign meats as a special class.

General Regulations.

After a careful perusal of these the impression gained is that Port Authorities generally will start their food inspection on a better basis than was the case with us in Manchester, the new powers being much better defined and a distinct improvement on those we have had to work under. At present the articles to be examined must be intended for human consumption, but in future, articles commonly used for the food or drink of man will be deemed to be intended for this purpose unless the contrary be proved. The Manchester power of inspecting articles of food on a vessel or in a warehouse within the Authority's jurisdiction is made universal. The powers of inspection, etc., are assigned to the Medical Officer of Health, but the Authority will be able, with the consent of the Local Government Board, to appoint a deputy Medical Officer and Inspectors to exercise such of the powers as they think fit; the Inspectors being required to act under the direction of the Medical Officer of Health.

Although examinations occasionally take place on a ship, the inspections in warehouses are the principal concern to an authority. At present my Inspecting Officer, being satisfied by sample that a certain proportion of a consignment is likely to turn out unsound, serves a notice of seizure upon the wharfinger in charge, and obtains the name and address of the owner for further notification. The Ship Canal Co., and the shipping firms having warehouses of their own, have agreed not to allow any of these goods so seized to be taken away without the consent of the Inspector or myself. The opening up of the rest of the consignment is then taken in hand by the owner, at his own expense, the authority being simply responsible for the inspection. In future the inspecting officer will be able to go on with his examination at once, simply calling upon those in charge of the ship or warehouse to unpack or uncover as much of the goods as may be necessary for the purpose of examination. Whether the owner of the goods or the Port Sanitary Authority is to pay the expense of this preparation for examination is not stated. My own view is that the wharfinger must provide the labour on demand, the cost being borne by the owner. In the rare instances where labour of this kind has been

required by the authority it has always been furnished, but only upon a signed requisition for labour being handed in by an officer of the authority, and the authority being made responsible for the charge. On the unsound articles being separated, the inspecting officer is at present supposed to seize these and at once carry them away to be dealt with by a magistrate, though he does not always do so on account of his arrangements with the occupiers of the warehouses. Under the Regulations he will be able to either move the articles or give notice to the person in charge that such must not be moved until dealt with by a justice, or until permission be obtained from the medical officer of health.

If the articles be surrendered for destruction, or the medical officer agrees to their being utilised for some satisfactory purpose, other than human food, they can, as at present, be removed under supervision for that purpose. The justice will deal with the unsound articles as now, if satisfied that they are unfit for human consumption, and it has not been proved to him that the sale for human consumption was not intended. If it be proved to the justice that the articles are not intended for sale for human consumption an order will be made dismissing the complaint, but setting forth such particulars of the goods as will suffice to identify them, along with the names, descriptions, and abodes, of the importer and the person who is to take delivery. A copy of this document will have to be furnished to the authority. Where an owner raises the contention that an article is not imported for purpose of sale for human consumption, and he has not satisfied the medical officer as to the purpose for which it will be used, it will presumedly be necessary to give him a chance to appear before the magistrate when a condemnation order is being sought for. The inspecting officer is to be empowered to take samples, but there is nothing to indicate that the authority will be expected to pay for these. In practice, however, most firms are willing to supply any samples required, though in a few instances my authority has paid the value.

The medical officer of health will have power to detain any consignment for any time not exceeding 48 hours, or for longer, by arrangement with the owner, if special procedure should be regarded as necessary for the purpose of the examination. This detention is apparently intended to allow time for the results of chemical and bacteriological examinations to be obtained. It should also enable the inspecting officer to detain, pending the decision of the medical officer on the condition of samples which he might have submitted to him. The utility of this Regulation will depend upon the elasticity which will be allowed to the medical officer

in deciding as to what may be considered as "special procedure" necessary for the examination of articles of food. The quality of food consignments generally is gauged on a percentage examination, and large quantities are passed as sound on this. If the percentage, on the other hand, proves unfavourable, a complete examination becomes a necessity, and from my own experience I should certainly class such as "special procedure." Notices served in connection with the Regulations may be sent through the post.

Provision is made for granting search warrants, but as the penalty for disobeying any of the Regulations is £100, I should not anticipate that these will be extensively required.

Specific direction is given in the Regulations to keep a record of all articles of food destroyed or otherwise disposed of. Although such a direction does not form a part of the Manchester Port Order of 1906, a record of every particular in connection with seizures, destructions and disposals has been kept in my office, and on several occasions has been utilised by interested parties as a trustworthy reference in case of doubt or dispute.

The Regulations should come into operation on the 1st September next, and will be applicable to all port sanitary authorities in England and Wales.

Foreign Meat Regulations.

The reason for treating foreign meat under a separate set of Regulations can readily be appreciated on perusal of a recent Report by Dr. G. S. Buchanan, of the Local Government Board, on "Certain Imported Meat Foods of Questionable Wholesomeness." This publication you are doubtless familiar with, and you will, therefore, be able to recognise at once that the Regulations are framed to deal effectively with the particular classes of meats indicated in the Report as requiring stringent treatment. I think we shall all agree that scrap meat and carcases of pigs, which present nothing to an inspecting officer to indicate whether diseased or not, are better out of the country, and that such popular articles as tripe, tongues and kidneys, should not be allowed a market in England when so heavily dosed with preservatives as has been proved to be the case.

Under the Regulations foreign meat is to be tabulated under four headings. Class 1 has reference to fresh or preserved "scrap" meat which cannot be identified with any definite part of a carcase, is without bone in its natural state of attachment, and has not been converted into sausage or other compound or manufactured article; tripe, tongues or kidneys packed in preservatives; severed and other edible parts of a pig, which have not been converted into ham or bacon, or are boxed without

an official certificate. Class 2 refers to entire carcases of pigs, not prepared as bacon and ham, which are without the head in its natural attachment, and without the lympathetic glands about the throat or other parts of the carcase in their natural position. Class 3 refers to severed and other edible parts of pork, which are boxed with an official certificate impressed on the outside. The fourth tabulation, "Unclassified," refers to any meat not in any of the three classes mentioned. All kinds of meat or meat preparations coming into the country will therefore be covered under these headings.

It will be the duty of the officer of customs to ascertain the presence of foreign meat and its classification on a ship arriving in port. In the case of meat of Classes 1 and 2 he must prohibit removal until examined by the medical officer of health. The medical officer will be advised forthwith, and he or his inspecting officer will examine the meat. The officer of customs will not be required to detain meat coming under Class 3, or unclassified meat, unless he has special reasons for so doing.* Should he do so, he will adopt the same procedure with respect to such meat as in the case of Classes 1 and 2. Should the officer of customs not place a bar against the removal of any foreign meat this will not interfere with the inspecting officer examining and dealing with such, should he come in contact with it. Should the meat come under Class 1 or 2 the inspecting officer will serve a notice in writing, forbidding the removal of the meat for any purpose other than exportation. If he is of opinion that the meat, though belonging to Class 3 or unclassified, should not be used for consumption in this country, he may give a similar notice requiring exportation, but if satisfied that it may be removed to a place of destination in England or Wales, for any other purpose than exportation, he may give a certificate to that effect.

The medical officer will presumably be required to send a copy of any notice for exportation to the clerk to the authority, who must within twelve hours after receipt of the same, serve a written notice on the importer, to the effect that unless he gives a written undertaking to export the meat, at his own expense, or will be prepared to prove before a justice that the meat is not intended for sale for human consumption, the sanitary authority will order the meat to be destroyed.. Any undertaking must be given within twelve hours, or the meat will be destroyed by the authority. If an undertaking to export be given this must be executed within three

* An intimation, given from time to time by the Medical Officer of Health to the Collector of Customs, that any particular kind of meat or meat preparation will require examination should constitute a "special reason."

days to avoid destruction. Should the importer undertake to prove before a justice that the meat is not intended for sale for human consumption, the authority must bring the matter before a justice within twenty-four hours. Should the contention of the importer not be proved, the justice orders destruction (not exportation), but if proved, he directs the removal of the prohibition, at the same time setting forth on his order particulars of identity of the meat, the importer, and the person to whom it is to be delivered. Full particulars of the seizures and disposals are to be kept by the authority.

As it would not always be possible to export undesirable meat within the three days' limit, owing to the requisite boats not being available within this time, from the port of landing, it is to be presumed that safe custody until the proper exporting medium has been provided will be regarded as sufficient.

So far as concerns official certificates attached to foreign meats, the only ones which will be recognised will be published in the *London Gazette*, as satisfactorily indicating that the meat has been free from disease, and has been dressed and prepared in such a manner as to prevent any danger to the public from contamination. It may be noted that the only meats requiring an official certificate under the Regulations as drafted are severed and other edible parts of a pig.

These special Regulations should come into operation on 1st Nov. next.

It would without a doubt have been interesting to have retailed some of my experiences of the unsound food which I have come across in the exercise of my duties in Manchester, but I must leave room for those who have to follow. I should like to point out, however, that experience teaches me that the bulk of importers are not at all difficult to get on with when they understand the working of food inspection regulations at a port. They approve of the principle of food inspection, and have no desire to import anything unsound. They are prepared to work in harmony with the inspectors to secure prompt dealing with any of their goods under suspicion, so that there may be no unnecessary delay in delivery, and they seldom dispute the decision of an inspector as to unsoundness. The certificates of seizure given by the inspectors in exchange for surrender have, furthermore, proved a distinct advantage to these people in arranging deductions from payments to the consignor. On the other hand, those people who are importing foodstuffs of a known risky character very soon give up the business after inspection commences. I unhesitatingly approve of the new draft Regulations. It is not to be contended, however, that they are perfect or final. I do not

doubt that experience will show the necessity of certain alterations and additions, and that these will be given effect to from time to time, but if they are put into operation, in the present form only, they will mark a distinct advance on previous methods of dealing with unsound food. Personally I am of opinion that a necessary corollary is their extension to railway stations. Cheap water transit is largely taken advantage of for transport of foodstuffs by coasters, and as many of the articles thus carried have been in store for a considerable time, and therefore subject to deterioration, they are often found unsound. Universal inspection at ports will necessarily divert this class of traffic to the railways. It would also not be amiss to have our home food products under supervision at railway stations, and as Glasgow and Leith are not affected by the Regulations they provide good openings for risky foreign foodstuffs to be landed and brought over the border by rail. But this feature, important though it is, should not deter us from heartily approving of the facilities to be given for inspection at our ports. The Local Government Board deserve every credit for the pertinacity displayed in pushing forward with their Regulations. That it has been no easy matter to frame them I know, but now that they are issued I trust that self interest will not be allowed to bring about any mutilation before they appear in their final form.

Dr. H. Williams (Port of London) said that he thought the new regulations were an earnest effort to deal with a difficult problem. The Unsound Regulations, 1st series, legalised the procedure which had been practised in the Port of London for many years. Attention was drawn to the fact that notice had to be given to the sanitary authority who would issue certain notices. That meant delay, as it would be necessary to call a special meeting of the authority.

Dr. F. M. Williams (Plymouth) asked whether the forecastle was inspected before transhipment from ship to ship at port of entry.

CONGRESS AT CARDIFF.

CONFERENCE OF VETERINARY INSPECTORS.

ADDRESS

By PROF. J. PENBERTHY. F.R.C.V.S.
PRESIDENT OF THE CONFERENCE.

IT can scarcely fail to be gratifying to us all to be called on to take part in acquiring and disseminating knowledge destined to improve conditions of human life. Pursuit of the original objects of our special branch of medicine always affords opportunities for preserving the health of the lower animals, thereby conserving the national wealth: but, sharing the best instincts of the human family, our loftiest aspirations lead us to regard the part we may be privileged to play in the conservation of human health as a duty of the highest order. Though not laying claim to special knowledge of morbid processes in man, as members of the community we may express a common interest and desire to join in the attempt to solve one of the most important and complex problems of our civilisation.

The set subject arranged by the Council of the Institute for discussion in this section is "Meat and Milk in Relation to Animal Tuberculosis." To those whose work entails the constant consideration of these matters it might appear that the subject has been laboured *ad nauseum*, but finality has not been arrived at. Many points concerning the relations of meat and milk to animal tuberculosis have, we believe, been definitely settled. The ground is clearer for action to-day than before, but times change and we must change with them. It has been truly said that the belief of one age may be the heresy of the next. A careful study of the views expressed by those whose position entitled their opinion to our respect will indicate that our subject is no exception. I take it, too, that one of the principal objects of this and similar gatherings is the education of public opinion, a task demanding the greatest delicacy and force, and beyond everything guidance by true principles and scientific accuracy. To effect our purpose it is essential that in our deliberations we realise the necessity for statements of fact, well conceived deliberate deductions, and practical

suggestions. The dissemination of crude, immature opinions, so many of which are doomed to explosion as based on worthless theories, is specially obstructive to the application of expert knowledge. The scares arising out of misrepresentation, exaggeration and dogmatism have, I venture to say, had a most deterrent effect on the crusade against tuberculosis in men and animals. The reason of the British Public must be appealed to, for John Bull looks for some solid basis for action before he embarks on a serious enterprise. When an idealist says he cannot admit the question of cost in making propositions, which threaten extraction of millions from the Englishman's purse, for purposes whose value is not well understood, he is not likely to induce the holder to relax his purse-strings and provide the essentials. This matter cannot be considered apart from cost.

I think facts prove that this stolid prudence is not always wrong. In relation to the matter about to be discussed, if action had been taken on the lines laid down by the most clamant enthusiasts of the past twenty years, we should at the present moment have neither home-grown meat for the English market, nor dairy-herds to render matter for our deliberations at this Conference. It will not be difficult to show that by exercise of the knowledge acceptable to common sense, public opinion focussed on Parliament has led to the adoption of measures, incomplete and insufficient as we now regard them, which have where adopted effected material improvements and paved the way for the application of others whose beneficial effect will, we hope, be still more marked.

Though the converse had been strongly suspected for many centuries, it is scarcely fifty years since Villimen demonstrated the transmissibility of tuberculosis of man to animals and communicated the disease so induced to other animals. The discovery of the tubercle bacillus by Koch, just a quarter of a century later, had a marked effect in establishing and generalising the view that tuberculous animals were a source of danger to man, an impression which spread so rapidly that consumption was often looked on as a disease of cattle transmitted to man by eating flesh or drinking milk. For some time the attention given to the matter by the public was mainly centred on the danger associated with the flesh. The confiscation and destruction of every animal which gave any sign of tuberculosis even the smallest speck of tubercle, was demanded. On this point scientific knowledge and common sense have prevailed, and at present it is generally held that in only a small proportion of cases is the flesh of tuberculous animals dangerous to the health of man.

Our experience of meat inspection will, I think, allow of the conclusion that where this is carried out uniformly and systematically by officers

having an intimate knowledge of animal diseases and pathological processes, and actuated by sound common sense, the public is amply safeguarded against the risk of contracting tuberculosis from consumption of home killed animal flesh, and the trader has little to complain of from unjustifiable seizure. It must, however, be insisted on that such highly important and responsible duties as the inspection of meat should be exercised only by those who possess the requisite knowledge. The special education of the veterinary surgeon in the laws affecting the health of the domesticated animals, in anatomical, physiological, and morbid states of their tissues, and pathological processes affecting them, bring within his view the consideration of the conditions under which tubercle bacilli may contaminate flesh used as food of man. In this consideration he will be guided by realisation of the fact that before flesh may be regarded as infective it must be infected. No greater obstacle to the removal of the danger has arisen than the irrational cry for the destruction of the whole carcase of every animal that has reacted to tuberculin, or which shows a single tuberculous lesion.

With the knowledge gained as to methods of inspection and the amount of animal flesh condemned as unfit for human consumption by public authorities sufficiently enligh tened to adopt the measures at their disposal, it is nothing short of a national disgrace that a large proportion of animal flesh offered for sale is not subjected to inspection, and that there is in the greater part of the kingdom no check on the traffic in diseased meat and cattle. On behalf of the unprotected portion of the community we make the demand for general and uniform inspection.

On the score of the protection of human health, as well as of home interests, we must insist on the production of some evidence of freedom from tubercle bacilli in imported meat. There is the demand for inspection of the viscera of our home killed cattle, and without it the best, indeed, the only reliable evidence of generalised tuberculosis may be wanting. If this is necessary in the case of our home bred cattle, surely we should have similar evidence concerning animals whose carcases are imported by us, and a reliable certificate of freedom from evidence of tuberculosis should accompany carcases so imported.

In Glasgow the seizures of meat on account of tuberculosis are represented as among home fed cows 50 per cent., imported cows 1·23 per cent. It is scarcely conceivable on any information we possess as to the relative prevalence of tuberculosis in any other country than Great Britain, that these figures represent the true state of affairs. In New Zealand, for instance, where tuberculosis is regarded as comparatively

uncommon, examination at the abattoirs has shown that out of 45,742 cows examined, 4,718, or more than 10 per cent., were tuberculous.

For convenience of meat inspection the public abattoir is superior and desirable, but the dislocation of the meat trade and cost to the ratepayer may not be kept out of consideration. From a veterinary point of view, it is sufficient to insist that every carcase and its viscera should be efficiently examined before being offered for sale. In country districts there are very real obstacles to the establishment of public abattoirs: and, if the general and uniform inspection of meat is not attempted until it is possible to do so in every case in public abattoirs, we fear a large supply of tuberculous flesh will continue to be dished up for many years to come.

In England and Wales in 1898, with a population of 31,397,078, there were registered 60,139 deaths from tuberculosis of all forms at all ages, or 1 to every 521 of population. Of these, 7,063 were of infants under one year of age, the almost exclusively milk-drinking period. Of this number 3,265, or 46·22 per cent., came under the head of *Tabes mesenterica, including tuberculous peritonitis*, that form of the disease attributed to ingestion of tubercle bacilli. These figures naturally indicated that the food of infants rendered them specially liable to the disease, and when statistics relating to the incidence of tuberculosis were examined, it appeared that a material diminution had taken place at all ages, except that of milk drinking. The inference very seriously incriminated cow's milk, which from change of parental habits had come more into use as an article of children's diet than formerly.

The Returns for 1906 show the deaths of infants under one year of age from all forms of tuberculosis to have been 4,601, a diminution of 34·8 per cent.: those from *Tabes mesenterica* and *tuberculous peritonitis* 1·914, a diminution of 40·9 per cent. This change has been effected in eight years. The same returns show that whereas in 1881 of the total deaths of the population 2·5 were attributable to tuberculosis, in 1894 the proportion had fallen to 1·7. In his reply to the deputation on legislation and the milk supply, the President of the Local Government Board, referring to my remarks that tuberculosis in infants was diminishing, said: "I am glad to say it is. It is diminishing in this country generally, proportionately more rapidly than in any other country in the world." These figures and statements are adduced to indicate an improvement of remarkable character, not as an apology for future inaction, but to incite enquiry and as a call for uniformity in the adoption of measures which have effected this beneficent result.

The report of the Medical Officer of Health for Liverpool for 1905

gives, *inter alia*, the following instructive figures, which may be taken as typical of improvement accruing to the action of other sanitary authorities who have taken the matter seriously and acted vigorously. For the period 1866 to 1875 the annual average death rate per 100,000 of population at all ages for all forms of tuberculosis was 430·8; for the year 1905 the figures had fallen to 225·4, or a diminution of 47·3. The average annual death rate per 100,000 of population below five years from *Tabes mesenterica, hydrocephalus* and *scrofula* for the period 1866 to 1875 was 637·1, and for the year 1905, 307·6, a diminution of 52 per cent. The most remarkable relative diminution in deaths at the milk-drinking age is that shown for the ten years prior to 1906, being nearly twice as great as the average diminution at all ages of the whole population, and the figures for 1906 indicate that this progress is being maintained.

In his report for 1907 the Medical Officer of Health for Birmingham remarks that possibly the cause of this large incidence of tuberculosis of the intestines in young children is the milk supply, and states that no less than 85 per cent. of the deaths from tuberculosis of the intestines were of children under five years old. There is a table showing that in 1902, 56 infants under one year old died of tuberculosis of the intestines, and in 1906, 30, a diminution of 46·4 per cent. In 1902 the number from one to five years old is 25, and in 1906, 22.

It is not possible to state what proportion of the deaths at the earlier or later dates may have had their origin in cows' milk or animal flesh, nor to form a very reliable opinion as to how far the favourable change is dependent on improvements in the milk supplied. We may, however, refer to what has been effected with milk. A table prepared by Prof. Sheridan Delépine, and published in the *Medical Chronicle*, in March, 1908, gives results of his highly valuable work in connection with the milk supply of Manchester. Samples of milk such as would have been supplied to the consumer in town were taken at railway stations and other places away from the farm. As a result of inoculation of guinea pigs it is shown that in 1898 17·2 per cent. of the samples yielded effective tubercle bacilli: in 1906 6·6 per cent.. As bearing on other infective properties we find that while in 1898 following 64·5 per cent. of inoculations no lesions were attributable to the milk, in 1906 the proportion rose to 84·7 per cent. Other figures speak equally forcibly of the higher degree of purity and innocuousness of milk on sale in Manchester in 1906 as compared with 1898. Of samples of milk taken the following contained tubercle bacilli: In Liverpool—town milk, 1896-1905, 2 per cent.; 1905, ·4 per cent.: country milk, 1896-1905, 9 per cent.; 1905, 3·5 per cent.; mixed dairy milk.

Birmingham—town milk, 1907, ·0 per cent.; samples taken from 81 suspected cows, 6·4 per cent.; mixed country milk, 1907, 13·3 per cent. Sheffield—1902, 17·8 per cent.; 1906, 9·5 per cent.

Whatever may be the connection between the diminution of tubercle bacilli in cows' milk and the decrease of tuberculosis of children of the milk-drinking age, it is safe to assume that the effect is largely due to the action of those authorities who, with other hygienic improvements, have included the veterinary inspection of cows, dairies, etc., and the removal of animals undoubtedly dangerous as discharging tubercle bacilli which gain access to the milk. This by no means closes the book, but I venture to think that indefinite as may be our knowledge of the proportional value of the several hygienic measures adopted, the veterinary inspectors may claim a not inconsiderable share in the provision of the more favourable conditions now obtaining, and as one deeply indebted to them and to medical officers of health for most valuable information always most generously given, I beg leave to take this opportunity to express my sense of obligation, and my admiration for the zeal and enthusiasm, and generally the consideration displayed in the discharge of duties not at all times easy or agreeable.

These few points in the cursory review of the situation as to meat and milk in their relation to animal tuberculosis indicate progress in the right direction. The whole community rightly claim the same degree of protection as that afforded to those sections numerically and intellectually strong enough to take advantage of the levers of civilisation for their social welfare. Had the powers exercised by our enlightened corporations affected similarly the whole community, the present conditions would have been much more favourable.

I do not suggest that the general adoption of such measures as are rendered available by the Dairies, Cowsheds and Milkshops Order or the special powers granted by Parliament to some large corporations are likely to accomplish within a measurable period the eradication of bovine tuberculosis from our herds. Experience tells us that something has been done towards safeguarding a portion of the community. To my mind it has proved that such veterinary inspection as has already been exercised is valuable. Results of examinations by experts of samples of milk by microscopic and inoculation tests prove, that, if the veterinary inspector be possessed of the necessary legal powers, he is capable, with some degree of certainty, of detecting and removing the offending cow from a herd, and thereby the danger for the milk. While it would be dangerous to overestimate the power of the inspector in this direction, I am bound to say

cases which have come under my own notice in which the origin of tubercle bacilli in samples of mixed milk has been traced by the examination of cows on several different farms have impressed me very deeply as to the value of his services. I am in possession of a letter from a medical officer of health who has given particular attention to the milk question for many years, and who is quoted as a high authority, which says: "The veterinary examination detects the disease earlier than the biological one, and every cow ought to be examined once in three months."

I am in full agreement with those whose ideal is the eradication of tuberculosis from cattle, as this would be the real safeguard of the public and to the true interest of the stockowner, and I realise that it is the duty of the veterinary surgeon to associate himself with all rational attempts to effect this. Doubtless the conference will be provided with opportunities of expressing their views on this aspect of the question, for its accomplishment would be the solution of the difficulty. It is a problem of such magnitude that we should not be justified in relaxing any efforts already found successful in diminishing the number of samples of tubercle from milk, in hope of early extirpation of the source. All of us are well aware that by aid of tuberculin, isolation, and the exercise of intelligent interest, patience, skill, and money, an individual herd may be purified and kept free. This is quite within the sphere of practical politics for individuals, and is in practice, and it is our duty to encourage, as far as possible, the voluntary effort, and to consider when time is ripe the recommending of its adoption by legislation. The recent report of the medical officer of health of a large corporation demands the universal and compulsory stamping out of tuberculosis by slaughter, "sterilisation and destruction of all animals which react to tuberculin," and estimates that "the disease in animals may be thus eliminated in a single year." It is, I am sure, unnecessary for me to comment on such quixotic ideas to this Conference, or for us to formally dissociate ourselves from them.

There are many reasons for thinking the process of eradication of tuberculosis of cattle must be gradual, though there is no question that legislation will provide measures directed to assuring a pure milk supply to the people. We have the word of the President of the Local Government Board for this, and I have no doubt this Government Department will control such measures. The suppression of tuberculosis in cattle will naturally come within the sphere of the Board of Agriculture, though I do not share the views of those who appear to think that an attempt will be made to stamp out tuberculosis by the means successful with pleuro-pneumonia. We need only ask ourselves what would be the

effect of slaughtering all animals affected with tuberculosis and those in contact with them. The sudden withdrawal of all reacting cows from supplying milk must mean the ruin of the dairy industry and the withdrawal of that nutritious diet which is most required to improve the physical element of the nation. I see no means of bringing tuberculosis within the sphere of action of the Board of Agriculture unless it is scheduled as a contagious animal disease, and I do not see why it should be beyond the wit of man to devise measures short of those referred to, which would remove at least the dangerous animals, for cows which are dangerous to man are often dangerous to their fellows, and the protection of the agricultural interest calls for the intervention of the Department of Agriculture.

It cannot be said that our knowledge concerning the relation of meat and milk to animal tuberculosis is complete. One Departmental Committee and two Royal Commissions have considered and reported on the subject in the past 20 years, and an immense amount of valuable information has been supplied. The interim report of that now sitting gives evidence of such masterly work, and the promise of more, that I am fain to think no Government Department is likely to take action on lines divergent from its findings, or to attempt to elaborate a scheme for the stamping out of tuberculosis, *par coup*, until its deliberations are complete and its final report issued. In the meantime, following the direction of the last paragraph of the interim report, which indicates "the necessity of measures more stringent than those at present enforced being taken to prevent the sale or consumption of tuberculous milk," I am inclined to think Mr. Burns will not fail to include all practicable means to effect a pure milk supply. It was my privilege to address the President on the matter of inspection, to indicate the apparent results of that already arrived at, and to receive the assurance that "in a subject like this he could not ignore the veterinary surgeon, that in any scheme he might bring forward he will not have a disproportionate place. If he should enter more largely into the scheme of inspection and supervision than he now does, and looks after other people, he may rely upon it that the Board of Agriculture and the Local Government Board are determined to look after him." To a conference of veterinary inspectors I may be permitted to add that the expressions of confidence in them were general and flattering, and I take it as evidence of work well and effectively done. It is evident that their work is not yet completed, and your presence bears witness to your interest in the matter and the determination to render yourselves competent to perform the duties which must devolve

on you. The equipment necessary to performance of veterinary inspection is of no mean order, and I am sure you all realise that the importance of the object in view demands the best you have within you.

My experience with tuberculosis in the lower animals has been somewhat long and intimate, and I cannot call to mind any individual who has expressed himself forcibly regarding it who has not had occasion to change his views. The experimenters and writers on the subject are so numerous, that even reports of scientists and experts often embarrass and hamper rather than clear the way. Deductions for one animal from experiments on another of different species do not always afford reliable basis for action. Common sense and the results of ordinary observation cannot always be carelessly brushed aside for new theories or statements which are incompatible with them.

In a report of experiments recently issued by Schroeder and Cotton it is stated that butter made from milk soiled by fæces of 40 per cent. of all cows that reacted to tuberculin, though they still retained the appearance of health, induced fatal tuberculosis in guinea pigs; that tubercle bacilli can be found more frequently in butter than in milk; and that butter injected into fifty guinea pigs caused forty-four of them to die of generalised tuberculosis, and some of these samples of the butter were nine days old. The report of another series of experiments by one of the same observers indicates the almost constant existence of effective tubercle bacilli in the fæces of cows which had reacted to tuberculin but remained apparently healthy. In view of these findings, the large proportion of our cows known to react to tuberculosis, and the alleged insanitary conditions connected with the milking process, it is most remarkable that our country milks, subjected to no kind of inspection, should even be so free from tubercle bacilli, as is shown by results of examination and tests already referred to. In fact, if the public were influenced to believe that what is fatal to guinea-pigs on inoculation is fatal to man on ingestion they would realise no means of escape from death except by disuse of all dairy products. As veterinary inspectors you can only be satisfied when the milk supplied under your control is proved free from the dangerous element. We must take advantage of all circumstances for discovering and applying the best means by which this can be assured, temporarily and permanently.

The eradication of tuberculosis must be our ultimate goal, the removal of the bacillus-distributing animal our watchword and means of suppression. Conditions favourable to the general health of the cow are usually, if not necessarily, unfavourable to the contagion. Sunlight, ventilation,

drainage, air space, sound food, pure water, cleanliness of the cow and her surroundings, and scrupulous care of milk are all favourable to the accomplishment of our task, but the crux of the matter is contagion, and we cannot hope to deal with tuberculosis effectually, except as with other contagious diseases, by removing it. This we must preach from the house top. We must try to convince the stockowner that tuberculosis is as much a scourge of the bovine as of the human species and that it is a source of serious loss to him, which can be largely averted by his voluntary action. We all know the difficulty of this task, as we realise the value of his co-operation, but we are not alone in this difficulty. Few things have been harder than to convince the public of the danger to his fellows of a human subject affected with phthisis, a fact which is too little realised or acted on at the present moment. I think it may safely be assumed that the legislature will soon help to secure the stockowner's conviction, and I trust his co-operation will be enlisted by just, if not generous, enactments that will call for notification and slaughter of animals with open tuberculosis, frequent inspection, withdrawal from the milk supply of cows affected with udder disease, slaughter of those found to be tuberculous, disinfection, improved housing, milking, and dairying, and that all will be directed to the ultimate elimination of tuberculosis from our herds.

The veterinary inspector cannot fail to have a share in this work, I believe the enthusiasm shown by those who have already been engaged in such work with such good results will infuse those who follow. The object is certainly worthy of all effort, and I trust the veterinary surgeon may rise to the occasion and show himself capable and fit for administrative as well as executive duties in connection with the suppression of animal disease, and the danger arising therefrom. In this direction, his success of action means not only prevention of the access of disease germs to man, but the provision of an increased supply of pure milk, which is one of the desiderata of the nation, whose position depends on the physical condition of her population, for which there is no better foundation in the shape of food, than a supply of pure milk. If the money spent in gin and beer were used in the purchase of pure milk, and the energy and parental care, now in abeyance to alcohol and thriftlessness, devoted to the health of rising generations, I venture to think we should hear less about physical deterioration, parsimony in nutrition, etc., for not a little of the blame attributed to the cow and the cowshed is rightly attributable to improvidence and neglect of the home and tuberculously disposed children. Indeed, it sometimes occurs to one that the trend of modern investigation

is to confine the attention too exclusively to the consideration of the seed, disregarding the soil on which it may be sown. The suppression of the tuberculosis of the human subject derived from the lower animals must finally be accomplished by education of the public in the general laws of hygiene, in aiding which such meetings as those arranged by The Royal Sanitary Institute and other such associations play no unimportant part.

In relation to tuberculosis we may learn from the Interim Report of the Royal Commission that in the production of the disease experimentally the determining factor is the dose in relation to the susceptibility of the animal. Whether the latter is inherited or acquired, or both, is perhaps not yet known. That a degree of insusceptibility to tuberculosis of cattle may be acquired by inoculation with tubercle bacilli of the human type would appear proved by several series of experiments. A method has already been adopted in practice, and from an official communication just received from Massachusetts, I am informed that the results seem very encouraging. Should we become possessed of the power to immunise our stock, the problem of eradicating its tuberculosis would be robbed of its greatest difficulties.

Another series of experiments, which may possibly have a bearing on the subject, was carried out at the Harpur-Adams Agricultural School, and it shows decisively that, at any rate in Shropshire, cows can be kept out of doors all the winter without interference with health, cost, milk or flesh production.

I cannot more appropriately terminate my remarks than by quoting from the speech of the President of the Local Government in reply to the Deputation to which I have had occasion to refer, and which cannot fail to call forth admiration:—"In forty years, in my judgment, better housing, more and better milk, less of other potent liquids, and general social advance, will practically abolish tuberculosis in all its forms in men and cattle. If you will help to contribute towards that result, ten, twenty, or forty years hence you will have builded better than you know by meeting here to-day."

MEAT INSPECTION & TUBERCULOSIS.

By ANDREW WATSON, M.R.C.V.S.,

Veterinary Inspector, Borough of Dublin.

WHILST the idea of better health and happier lives for the people is common to all, the way to arrive at this desideratum is often the subject of acute contention: and the subject of meat inspection is an instance where the issue is often joined. Some medical men arrogate to themselves the position of being alone competent to decide what is wholesome food, whilst the veterinarian is equally insistent that he is the person most competent to judge. Now this spirit of contention if fostered will do much harm to the cause; both sides wish to prosper. I submit that both have their province, and by keeping within their respective provinces no friction need result. The medical and veterinary professions are interdependent on one another, and if they are to progress no spirit of self assertiveness ought to exist. Personally I have had the honour of working with the superintendent medical officer of health for Dublin for some nine years, and have to record nothing but fatherly care and brotherly help from him in the discharge of my duties.

In my remarks I do not assume the role of professor, but endeavour to speak from a broad common sense standpoint, which is our best guide in all affairs of life. I shall, as far as possible, leave out details on pathology and bacteriology. I only want to refer to some facts that have come under my notice.

All meat inspection should begin with an inspection of the animals during life, and I therefore make a brief survey of the leading clinical symptoms during life. The ox will take the foremost place, for the obvious reason that it takes that place in butchers' shops, and is most affected by disease.

The clinical symptoms of tuberculosis vary, depending on the extent of the disease, its age and seat. For purposes of ordinary examination we generally look for two forms: the invasion of the parenchyma of the

lung, constituting a form of tuberculosis broncho-pneumonia, or that involving the serous membranes, and constituting tubercular pleurisy, or tubercular peritonitis. Again, we have the acute and chronic forms, which may change from one into the other. In the acute form the symptoms will depend on the organ or organs affected. However, in the acute condition we have always a high temperature, up to 105° or even higher, quick respiration and accelerated pulse. When the lungs are involved we may discern the presence of the disease by auscultation. The abdominal respiratory movements become shallow, and twice as quick as in the normal. The nose is dry, appetite disappears, and the eye gets a glassy look. In the chronic forms there may be a complete loss of physical manifestations, although large lesions exist. In fact, in many cases the animals put on condition as well as if nothing were amiss. It frequently happens that there is a shortness of breath, and a chronic cough, which comes on upon the slightest provocation, such as rising suddenly from the bed, or on the admission of a cold draught of air. Auscultation in a cow is greatly obscured by the thickness of the muscles and the fat over the ribs. The sounds of the lungs are also likely to mislead by the rumbling and gurgling of the abdominal viscera. The condition of the coat is of importance, for it loses its lustre and becomes dry, "starey," and what is known as "hide bound." Constipation may be present; in the case of the cow the quantity of milk is lessened, or no milk is secreted. Sometimes the quantity is little altered, but its consistency becomes less (more watery). If the chest is percussed we may or may not get dulness; but it is frequently attended by pain, which is evidenced by the animal moaning. In the young animal more particularly, but also in those more advanced in years, when the glands in the throat are the seat of tubercle, we have a swollen condition of the parts, and a very distinct snoring noise. The udder when affected develops irregular hardened masses, varying in size according to the age or bacillary strength of the localised infection.

In pigs the symptoms are, roughly, a marked unthrifty condition, erratic appetite, cough, and frequent diarrhœa.

The tuberculin test is the only trustworthy diagnostic means we have of clearing up all doubts, but unfortunately in a fair or market, time and place preclude its use.

Now these symptoms are doubtless indicative of tuberculosis, but it is only by careful observation, and that in conjunction with lengthened experience, that they can be utilised as a guide. Take for instance the

wasting of an animal, and particularly where dentition is not complete. I have in many cases found that the wasting was occasioned by defects in the molars, resulting in a state of semi-starvation. Now pining is an excellent indication to arrest our attention and suggest that the tubercle bacillus may be at work. I must admit that it has lead me astray, even in cases where I heard from a trustworthy owner that the wasting had been going on for months, the post-mortem failing to reveal any tubercular lesion upon exhaustive examination of the viscera and lymphatic system.

Again, let us take coughing in conjunction with general atrophy of the carcase; have we not all found on post-mortem that no tuberculosis was present, but an emphysematous condition of the lungs with some bronchitis, the only lesion discernable. I am speaking of animals where one had only recourse to macroscopic examination in a market, fair, or sale yard. Temperature is a valuable accessory to our clinical symptoms. But it, too, is not infallible, for the temperature of our bovine patients is variable, and must be acted on with caution, and in relation to other conditions present, or else the mistakes indicated in the other cases will occur. I will not go through the whole list of symptoms, as time or space will not allow, but will ask you to take me as saying ditto to them. All must be noted, and he is the best practitioner who draws the most correct deductions from these data. A story is told of an apprentice artist asking his master how he produced some lovely colours that were on a canvas they were viewing; and the master painter's reply was, that he mixed his paint with brains; so it is with us in our inferences drawn from all available sources. This difficulty of diagnosis proves that none but the man of special training, study, and observation is competent to be the judge of tuberculosis in the lower animals. Needless to say, that man must be a veterinarian. Yet we find in the Local Government Orders little or no direct mention made of a veterinary surgeon.

We will next review the post-mortem appearances. The condition of the carcase when the hide has been removed should be noted, to determine whether the carcase is well nourished or otherwise. Of course I assume that the viscera have been removed and the carcase is hanging up. The colour, consistence and odour of the muscular system also calls for note, as in the case of generalised tuberculosis the muscles are usually much paler than in the healthy animal, due regard being given to its age. The flesh conveys a flabby soapy feeling to the hand, and lacks the agreeable odour found in healthy beef. However even in well-marked

cases of tubercular pleurisy or tubercle of the peritoneum, little or no change is observable in the carcase as regards the distribution of its fat, or in the colour, odour, or consistence of the muscles.

We must next look into the inside of the carcase and note the condition of the serous membranes. Care must here be observed, for masses of fat often become irregularly distributed between the pleura and the ribs or the intercostal, and might be mistaken for abnormalities, antecedent to *rigor mortis*. In the sawing of the backbone particles of bone from the teeth of the saw often adhere to the pleura and a hasty observer might be deceived by their resemblance to "young grapes." The normal appearance of the pleura and the peritoneum should be thoroughly mastered, as it is of the greatest assistance in the detection of tubercle in the early stage, and also as to whether stripping has been resorted to or no. Tuberculosis of the pleura covering the ribs in the early stage presents the appearance of small vesicles, somewhat like the vesicle in human nettle rash; a little later it develops an appearance like a wart and may remain like warts of varying sizes and characteristics. They are actually called warts by working butchers in Dublin.

In some cases these warts form into masses, called correctly grapes from their resemblance to that fruit in form. Some liken the earlier stage to pearls. There may or may not be evidence of pleurisy by the presence of organised bands of lymph, or even by distinct patches of pleura greatly thickened and bereft of its shining appearance. I have frequently noticed the serous membranes most extensively affected, without the slightest infection of either the lungs, liver, or spleen, or their lymphatics. Some high authorities are of opinion that tuberculosis of the serous membrane rarely leads to a generalization of the disease.

Before we proceed further it will be as well to define what is meant by generalized tuberculosis, and the following definition of Weigert certainly conveys the idea in a concise way:—

> "In cases where the systemic blood has become the carrier of the virus, we characterize this condition as generalized or general tuberculosis."

Ostertag points out in his work on meat inspection that:—

> "This distinction is of the greatest importance for meat inspection, since tubercle bacilli gain entrance into the musculature 'the meat of traffic' only by the aid of the circulating blood. The musculature therefore can be considered as infected and injurious to health only when the organisms of tuberculosis *are distributed through the body by means of the blood*. Tuberculosis of domesticated animals has a pronounced tendency to localization."

Next we examine the viscera, beginning with the lungs. A good plan where the disease is not visually in evidence is to handle the organs and feel for any nodules. If any nodules are felt cut down on them. I think that caution is called for here, and if the knife has cut through a tuberculous mass it should be sterilized to avoid infecting other parts. No matter where the lesion is, its condition as to being caseous or recent should be noted, for the caseous condition is not so infective as the acute stage. The bronchial and mediastinal lymphatics can now also be examined, and it is singular the number of cases in which they will be found to be markedly affected, with little or no lung invasion, whilst they are nearly always affected when there is tubercle of the lungs. The liver and its lymphatics come next, and here again my experience is that the number of cases in which you have the portal lymphatics seriously involved, without noticeable lesions in the organ itself, is altogether out of proportion. The spleen is now looked to, but it is in my experience seldom the seat of the disease. The stomach, intestines, and omentum now call for attention, and here again it must be remarked, that although the whole of the external surface may be covered with the disease, yet the animal may have suffered little or no systematic disturbance, judging by its being well nourished. We should next cut into the numerous lymphatics embedded in the mesentery. Again I have to remark on the large number of animals which appeared healthy during life, and yet the post-mortem revealed the glands to be solid masses of tubercle. In almost all cases, however, caseation had developed. The number of cases in which tubercle of the coats of the stomach and intestines is discovered on macroscopic examination are very few. The uterus is not by any means a rare seat of tuberculosis, and demands attention by the meat inspector. I have found in my work a goodly number of animals affected with tuberculosis of the kidney. In the case of cows the udder may be removed from the carcase and incisions made into it after the organ has been handled, as in the case of the lungs. Hardened nodules that might otherwise escape notice will be felt in this way. The lymphatics most easily examined without serious injury to the carcase are the sternal, dorsal, inguinal, and prescapular, and those already spoken of as being adherent to the viscera. As the tongue of oxen constitutes such an important part of table meat, it is essential to examine the submaxillary glands.

It may assist us to review an analysis of the percentage of the affected animal organs as taken from the German abattoirs :—

Distribution of Tubercles in different Organs of Cattle, per cent. of affected Cattle.

Lungs	75 per cent.	Liver lymph glands	1 per cent
Mediastenal and bronchial glands	29 „	Pharyngeal glands	4 „
Costal pleura	47 „	Stomach	·16 „
Visceral pleura.....	55 „	Udder	1 „
Liver	28 „	Iliac and inguinal glands	·6 „
Spleen	19 „	Pericardium	·9 „
Uterus	10 „	Kidneys	·7 „
Lumbar glands.....	5 „	Muscles.....	·1 „
		Larynx	1·3 „

What strikes one most in this table is the 75 per cent. affected in the lungs, the 19 per cent. affected in the spleen, and only ·16 per cent. in the stomach. In the table I quote from, no mention is made of any in the peritoneum or in the mesenteric glands being affected.

Now let us glance at Leipsic, and surely we shall gasp:—

Lungs	100 per cent.	Udder	17 per cent.
Pleura	57 „	Heart	52 „
Liver	83 „	Bones	9 „
Spleen	18 „	Muscles....	49 „
Peritoneum.	57 „		

If this be correct, and I have taken these figures from Law's "Veterinary Medicine" (Vol. IV., 1906), surely our country is to be congratulated on the freedom of its stock from such serious infection.

I now give an analysis of carcases suffering from tuberculosis during the year 1907 at the Dublin abattoir:—40 condemned as unfit for human food, suffering from generalised tuberculosis (27 were very wasted, and 13 were well nourished). 88 were locally affected as follows:—

Peritoneum ..	30·7 per cent.	Pleura	6·82 per cent.
Lungs	11·37 „	Lungs and pleura	51·13 „

Unfortunately the records were not kept of the invasion of the lymphatics, but my recollections are that an overwhelming number were badly affected in the mesenteric, bronchial, and portal.

We will consider the disposal of affected carcases. The conclusions of the Royal Commission appointed to inquire into the relations of human and animal tuberculosis have negatived the postulate of Koch, and in view of the enormous death-roll every year from tuberculosis in its various forms in Great Britain and Ireland, our duty is plain, to condemn all meats where tuberculosis has become generalized. In fact, if we could secure compensation for the owners of cattle affected with tuberculosis

when they sell them for food not knowing them to be so affected, I think it would be only right to condemn all carcases, no matter how slightly affected. Human life is of great moment, and no risks, no matter how remote, should be run. In the case of pigs, I condemn all carcases affected, slightly or otherwise, for it is admitted that tuberculosis in the pig has a greater tendency to generalisation than in other animals. The recommendations of the Royal Commission dealing with the utilization of tuberculous carcases are much too generous. For instance, it is considered permissible to pass a carcase where the lesions are confined to the lungs and the thoracic lymphatic glands where the carcase is otherwise healthy. Now in my judgment it would be impossible to have a healthy carcase where you have tubercular lesions in the lungs and thoracic lymphatics in the acute stage. After reciting what is permissive in allowing a carcase affected with tubercle to be used for human food, it is laid down in the recommendation that "when the lesions are confined to any combination of the foregoing, but are collectively small in extent," and the carcase otherwise healthy, it can be passed. How could a carcase be healthy with a combination of lesions in the lungs, and thoracic lymphatics, the liver, and the pharyngeal lymphatics? The Commissioners forgot to add, I think, the important proviso, that the lesions should be in caseous or calcified condition. Now the stage of caseation reduces the infectivity very considerably, and of course calcification leaves it non-existent.

In cases of tuberculosis of the pleura costalis, it is generally considered sufficient "to strip." Would it not be better to run no risks, and to remove the ribs and intercostal muscles? In the case of affection of the peritoneum it is best to cut away the abdominal walls. All organs, no matter how slightly affected, should be destroyed.

In Germany they have a system of dealing with tuberculous meat by boiling, and thus sterilising, which admits of it being used with freedom. The place where this is sold is called a Friebank. The meat is cut up and put into a closed chamber, and here it is subjected to steam at a temperature of 212° F. for about an hour. The steam is alternately shut off and re-admitted in order to assist penetration into the centre of the meat. I cannot do better than quote the conclusions of the famous Dr. Ostertag, of Berlin, as to the question of the fitness of the meat of animals which were affected with tuberculosis for the food of man, as all admit his claim to our best attention and confidence for sound judgment.

> "We must consider the meat of tuberculous animals which are infected with undoubted localised tuberculosis as harmless. To this category belong

all classes of localised tuberculosis in which the tuberculous processes possess a purely caseous or calcareous character, and are not prevalent. We must render similar judgment concerning all healed cases of typical generalisation restricted to the internal organs. As injurious to health, on the other hand, we must characterise the meat of all cases of generalisation with tuberculous alterations in the muscles, bones, joints, and lymphatic glands of the muscles, and also all cases of fresh generalisation with tumefaction of the spleen and lymphatic glands. We must consider the meat as probably possessed of a harmful character to a high degree, and must treat it in the same manner as that which has been shown to be harmful in cases where the local character of the tuberculous process is doubtful. This is especially the case in the formation of extensive cavities in the lungs, mesenteric glands, or liver, since in addition to the experiments of Kastner, experience teaches that in the presence of tuberculous cavities frequent outbreaks of tubercle bacilli into the blood takes place. The meat of emaciated tuberculous animals is to be judged as highly unfit for food, without regard to the tuberculous processes."

Further comment on this question is superfluous, and I will pass to the question of how much human tuberculosis can be attributed to direct infection from eating tuberculous meat. I admit that it would be impossible to give irrefragable figures, but I am of the opinion that the veterinary profession have allowed their medical friends to attribute too much infection in this question to our bovine patients. The great majority of mankind who die from consumption are the victims of pulmonary tuberculosis, between the ages of 15 and 45, and it is highly improbable that they were the victims of eating tuberculous meat, or the disease would more likely be tabes mesenterica. Tabes mesenterica may be due in a large measure to tuberculous milk, as it most frequently occurs in children. That consumption of the lungs has diminished enormously during the last forty years is proven by statistics, and this supports the contention that meat eating is not the influencing factor, for there is no such appreciable decrease in the disease amongst the veterinarians' patients. Further, this is proven by the fact that of guinea-pigs designedly fed on tuberculous matter the number that contracted the disease are comparatively few, whilst of those fed on milk taken from tuberculous udders, the numbers were very great.

Let us glance at a few figures as to deaths from pulmonary tuberculosis in Ireland, taken from a report of the Census Commissioners. It appears that the number of deaths from *pulmonary tuberculosis* from June, 1831, to June, 1841, was 135,590. The Commissioners remark that this malady is "by far the most fatal affection to which the inhabitants of this country are subject." From 1841 to 1851 deaths from *pulmonary tuberculosis* were 153,098; from 1851 to 1861, they were 130,739.

Now surely these figures support the opinion that infection by meat is scarcely the magic factor of disseminating the disease in the lungs, or we should have far more notice taken of the intestinal form of the disease.

A comparison of tuberculosis in England, Scotland, and Ireland shows that in 1864 Ireland stood lowest with a rate of 2·4 per 1,000 living, the rate for England being 3·3, and that for Scotland 3·6. In 1905, Ireland was highest with a rate of 2·7, Scotland being next with 2·1, and England lowest with 1·6.

Now, during all these years I am confident the people of Ireland ate less meat per head than either those of England or Scotland; and yet we see that tuberculosis of the lungs has increased in Ireland, whilst it has very much decreased with our friends on this side of the channel who are pronouncedly carnivorous. If meat were the initial cause, the reverse would be the case.

Dr. Lindsay, Professor of Medicine, Queen's College, Belfast, in a paper read on behalf of the Women's National Health Association of Ireland in Belfast last year, says "and probably our meat supply in a minor degree is also one of the sources of danger."

I will not pursue the argument further, for I agree that probably meat in a minor degree is one of the sources of danger; and milk is very much more likely to be a genuine source of danger. After all, meat is cooked, and this cooking must destroy the bacillus of tubercle; but milk is generally taken as it comes from the cow without cooking or sterilising. Again, milk is the food of infants, whose power of resisting disease is, generally speaking, lowest.

I, however, advocate the strongest powers to deal with tuberculous meat. Indeed, it is my opinion that the law on this subject could not be too comprehensive, or the penalties too severe for all who would try to sell meat affected with this dreadful disease. However, be tubercular infection from meat much or little, none will deny that meat inspection is imperative if the public health is to be safeguarded; for tuberculosis is only one of the many diseases that can be communicated to man by eating flesh: and yet how few of our large cities have adopted the ways and means of proper meat inspection. How few have established abattoirs and abolished private slaughter-houses? Whether it be for safeguarding the public against tuberculosis, or anthrax, or other disease, no effective inspection of a city's meat supply can be carried out without a properly equipped abattoir. In Ireland we are engaged in an organised attack upon tuberculosis, under the inspiration of Lady Aberdeen and the

Women's National Health Association. The assistance of none is neglected in this effort. In the battle against "the white plague" all can join: medical man and veterinarian; professional and layman; and there could be no better platform for the combined intelligence of all, and no broader field for their exertions, nor one better suited to call forth all that is best and noblest in our common humanity.

Mr. J. W. Brittlebank, M.R.C.V.S., *also read a Paper, on "Milk and Tuberculosis."*

Dr. J. Spottiswoode Cameron (Leeds) said the President had spoken of the finding of the Royal Commission that the production of tuberculosis was a function of the dose, and the susceptibility of the individual. It was sometimes thought that medical officers of health paid too much attention to the infection. But why had they been clearing slums and waging war on overcrowding except to lessen the susceptibility of the individual? Mr. Watson had pointed out that pulmonary phthisis occurred principally between the ages of 15 to 45, but was it not possible that this was due, not to a new infection from without at that age, but to the infection from old-standing latent tubercle, due to a previous infection, sometimes possibly from milk in childhood?

In regard to meat, was it always sufficient to remove gross lesions of tubercle and let the meat pass? Why does a waster waste? Not always, not even generally from the destruction of important organs, but rather from the absorption of toxines, formed during the growth of the tubercle bacillus in the nitrogenous tissues of the animals. Was the meat containing these toxines fit for food? The public paid for good meat, the meat of healthy animals, and had a right to get what they paid for.

Both papers were valuable as indicating the difficulties of diagnosing early cases. It was difficult enough in man; it was probably more difficult in the ox. Would it not be better to secure the testing of every herd by tuberculin? He would not necessarily kill all reacting animals, but he would have them watched and their udders examined by a veterinary surgeon, not once in three months, but at least once a fortnight; the milk every few months tested for tubercle bacilli by inoculation of the guinea-pig.

Dr. W. G. Savage (Colchester) remarked that in such a Conference it was of great importance to have clear ideas of the probable danger of tuberculous milk and meat to human beings.

In regard to meat Mr. Watson remarked that he thought the Royal Commission recommendations were much too generous. The speaker's view was

that on the whole these recommendations were sound and practical. With regard to the danger of tuberculous meat a broad view must be taken. Theoretically all parts of an animal with any tuberculous lesion, however slight or local, were capable of causing tuberculosis in human beings. Practically, however, it must be remembered that meat was invariably cooked, while also tuberculosis was essentially a question of dosage. While, therefore, in theory all parts of every tuberculous animal were potentially dangerous, in practice those recommendations were sufficient. Especially was that the case in view of the comparatively little power they had to prevent the dissemination of human tubercle bacilli.

With *milk* the position was somewhat different. Milk was consumed raw to a large extent, and was largely given to susceptible children. The danger from tuberculous milk was much greater than from tuberculous meat.

Mr. Brittlebank had referred to the existence of tubercle bacilli in milk from cows whose udders were free from all clinical signs, but which postmortem showed definite tuberculosis. They could go further, in view of the work of Moeller and others, since they now knew that tubercle bacilli might be present in the milk without signs of clinical or postmortem lesion in the udder. Probably those tubercle bacilli were derived from the intestinal tract of diseased animals. This fact pointed to the need for bacteriological examination, as well as veterinary inspection.

Mr. James Steele (Glasgow) said that as to milk in the City of Glasgow, they found great difficulty in having a standard for tuberculin. Herds when tested by their own veterinary surgeon reacted to a very large percentage. When herds in the surrounding counties were tested, the results were the reverse.

While approving of a rigid inspection of all animals slaughtered for human food, attention should be called to the large amount of boneless meat imported at different ports of the country, and would suggest that the Government ought to take up the inspection of all meat imported in boxes, barrels, etc., and appoint inspectors for that purpose.

Mr. Percy S. Howard (Wanstead) said that in regard to the various administrative proposals regarding tuberculosis, there was one in his opinion which promised more than any other, and that was scheduling the disease under the Contagious Diseases Animals Acts.

He did not mean with accompanying drastic measures at first, those could come later; and it would have the effect of drawing the attention of farmers and others to the existence of disease amongst their animals, and educate them as to the precautions which should be adopted in respect to isolation of diseased animals, etc., so far as their premises would permit.

Another advantage of such procedure would be to enable live tuberculous animals exposed for sale in markets to be dealt with effectively, which did not appear to be the case in many instances at present.

Mr. W. A. Della Gana (Southampton) said that he thought that all imported meat and milk should be submitted to examination (bacteriological and chemical) at the port of arrival.

Owing to difficulties in arriving at a certain and immediate diagnosis of bovine tuberculosis in the early stages, they should rely solely upon the tuberculin test, and accept results as final. All tuberculin ought to be standardised and derived from one source, preferably a Governmental one; veterinary inspectors and other duly licensed persons alone being supplied. Use of tuberculin by laymen should be prohibited, and thus prevailing abuses corrected.

Lieut.-Col. A. M. Davies, R.A.M.C. (London), referring to Mr. Watson's statement that he would condemn all carcases of pigs affected slightly or otherwise with tuberculosis, owing to its tendency to generalisation, stated that he had it on the authority of a veterinary inspector of great experience in London, that cases did occur in which tuberculosis existed, *confined to the pharyngeal glands*, and in which there was no generalisation. Such carcases, under the present regulations, had to be condemned. It seemed as if that regulation was too stringent. In the particular glands referred to, the explanation of the existence of the lesion lay in the fact that the pig was a miscellaneous feeder, and occasionally took in some sharp object (a bone or a pin) which abraded the pharyngeal mucous membrane, and so afforded way of entrance for tuberculous infection: this was held up in the adjacent gland, and no further extension occurred. The carcase was otherwise perfectly sound and fit for food, very likely in prime condition, and yet had to be rejected.

Mr. Willett, Councillor Hopkin, and Mr. Davies also took part in the discussion.

CONGRESS AT CARDIFF.

CONFERENCE OF SANITARY INSPECTORS.

ADDRESS

By G. H. ANDERSON,

Chairman Central Executive Council, Sanitary Inspectors' Association,

PRESIDENT OF THE CONFERENCE.

(MEMBER.)

IN the first place I desire to express my sincere thanks to the Council of The Royal Sanitary Institute for extending to me the privilege of presiding over this important meeting of sanitarians assembled to-day in Cardiff. The honour is greatly enhanced by the fact that it comes during my term of office as Chairman of the Executive Council of the Sanitary Inspectors' Association.

I think you will agree that the Council of The Royal Sanitary Institute deserves great praise from the public in general, and sanitarians in particular, for arranging these annual health congresses in various parts of Great Britain and Ireland. They are the best possible means of stimulating public opinion, they also invite the criticism and co-operation of all those who are interested in carrying out the numerous Acts for improving the conditions of the people.

I will not dilate upon any set subject lest my remarks may overlap in some degree the papers that are about to be submitted. My remarks will rather be general, and I trust that our deliberations may, by the interchange of ideas, prove beneficial to us as sanitarians, to the municipalities by whom we are employed, and to the general public whom we serve.

Since September, 1906, my thoughts have frequently turned to the paper contributed by Mr. W. W. West, at the congress of sanitary inspectors held in Blackpool. At the outset I desire to say that I for one responded to his call for a revival of the old crusade with cleanliness as our standard, and I would now press on you to return to it, and, whilst fighting for it, to give your whole and undivided allegiance to

that motto. We claim that we are the apostles of cleanliness, our mission is to seek out and purify what is foul in our various districts, and ever to remember when acting as public officers that the greatest good will result from our work, when we are able to successfully combat ignorance and vested interest, by proving the reasonableness of our requirements.

I do not for one moment desire to minimise the necessity for scientific research as to the absolute origin of disease; by all means let this proceed, and let us hope for further knowledge. Nevertheless, if the searching for the unknown is to become a fetish, if it is to overshadow the value of what we actually know, then I fearlessly say that it were better that the search proceeded no further, and that we should depend upon the proved value of cleanliness alone.

Much has been said as to what is the duty of a sanitary inspector, and what is that of a medical officer of health. I would venture at once to suggest that in the great work of improving the health of the people, that the *man and the germ*, as representing the soil and the seed, shall be left to the medical officer of health, and to us should be committed the environment of the man. Intimate indeed is the connection between our work, and the resultant harvest will entirely depend upon the careful blending and utilisation of our joint efforts.

Scientific research as to the germ and its action upon the body deals with matter possessing innate and differentiating force, and cannot therefore ever be brought to the accuracy of astronomical or chemical science. Hence it is essential that the environment should, as far as possible, render this force incapable of extending injury.

It is impossible to dogmatise as to germ action, or as to the results of germ action on individuals, the most that can be done is to state its results on a proportion of those under its influence, and we sanitary inspectors are not specially trained to follow all the theories built around this subject which proves so fascinating to the public.

But the lessons of the past lie ready to our hand. Cleanliness is next to godliness, and prevention is better than cure. Where the sun shines the doctor cannot get a living, so we must not be led away by the fascination of the unknown and attempt to obtain useless credit by dabbling in the mysteries of, say, tuberculous germs in milk. Ours the prosaic and lowly task of securing *cleanliness*, of the udder, of the milk pail, the floors, the walls, the pond. Our labours may often be forgotten, but the harvest will be found in an inevitable improvement in the public health.

Professor de Chaumont years ago claimed that if overcrowding was non-existent our death-rate would be reduced by *one-fourth*. The abate-

ment of overcrowding is certainly our work, and a result such as is foreshadowed dwarfs the possibilities of even the removal of phthisis by the extirpation of its germ, for even this fearful disease is only responsible for *one-ninth* of the total deaths.

In the first Presidential Address delivered by Sir Benjamin Ward Richardson to the Sanitary Inspectors' Association he laid great stress upon the unique value of cleanliness, and said that if by some magic spell England could wake up to-morrow clean, she would wake up pure in spirit and godly in the comprehension of goodliness. Cleanliness covers the whole field of sanitary labour, it is the beginning, it is the end. Practised in its entirety it would banish disease from the world, and Sir Benjamin claimed that all methods for preventing disease without cleanliness were mere sounding brass and tinkling cymbals, nothing else touches the death-rate.

The present Principal Medical Officer of the Local Government Board, Dr. Arthur Newsholme, in speaking of the duties and the difficulties experienced by sanitary inspectors, said it was their duty to watch and track in detail all conditions which make for disease. Many of their duties were irksome, and might appear even paltry in their detail, but whilst they were acting as home missionaries to the poor and helpless, in so far as they increased their cleanliness and self-respect, their influence on the community could not be overlooked.

I have tried to give due importance to that prosaic side of sanitation cleanliness, and I ask you not to allow the red herring trail of bacteriological science to be drawn across your path. Our work will still be required when all germs have been localised and duly allotted to their special functions, their life history defined and well understood.

The enormous improvement in public health that has taken place, the stupendous result in life saving and health promoting that has been accomplished by sanitary inspectors, cannot be better expressed than in the words of Sir Edward Chadwick, when, after giving us a series of statistics, he said that though his facts were high and dry, yet they would form a good basis to build upon long after he had ceased to be. They would suggest to us the grandeur, the importance, and even the solemnity of our work.

Though some would call the removal of some of the most offensive causes of death and disease *menial work*, yet it was work that conveyed a practical lesson to the world, of the methods whereby the happiness, the brightness, the comfort and strength of the world were secured. We might accept it from him, as one who had seen eighty-six summers, that ours was

as good a work as the sun ever shone on, and that long before another eighty-six summers had passed away it would be recognised as work deserving of the fullest recognition and the most befitting rewards, if it continued to be carried out in the spirit, as in the letter, faithfully, vigorously, hopefully and manfully.

Surely we may here bring our minds to bear upon the practical side of sanitation, the details of the structure of the houses the people live in, the cleanliness of the flocks of the beds on which the people sleep (the dangers of which have been so vividly denounced by Mr. Peter Fyfe), the purity of the food they eat, the condition of the dairy, the slaughter house, the butcher's shop, the travelling van, the canal boat, the means of preventing the fouling of the atmosphere by smoke, and the hundred and one matters upon attention to which depends the public health, well knowing that if the immediate environment of the people be clean, the germ has little chance of finding a resting place.

But in our strenuous efforts to obtain the conditions necessary for the proper environment of the people, we must necessarily frequently fall foul of those stumbling-blocks to progress, ignorance, vested interests, and the so-called liberty of the subject, and we may be persecuted by one or other of them. Surely this is sufficient reason why we should have adequate protection by a proper tenure of office whilst fighting such giants.

Dr. Arthur Newsholme has himself told us that insecurity of tenure of office is a grievous difficulty in the path of some inspectors. The duties of a sanitary inspector are such as almost necessarily bring him into antagonism with those amongst his employers who are owners of house property, and especially does this occur in districts where insanitary conditions are rife. The fact also that the inspector is liable to risks connected with periodic re-election handicaps his work, and renders it extremely difficult for him to discharge his duties in a fearless and fully satisfactory manner.

Perhaps there is a better time now approaching, for maybe the eminently practical President of the Local Government Board, Mr. John Burns (from whom sanitary inspectors have expected so much, and have received so little) may be brought to appreciate the value of our work, and support us in our laudable endeavours to improve the conditions under which the people live.

Most of us will agree that there is ample scope for women in the administration of public health work. There are numerous duties which they are particularly fitted to discharge and do so with infinite credit to themselves and advantage to the service. Visiting the houses of the

poorer classes and pointing out the advantages of order, cleanliness and ventilation in their homes; instructing young mothers with regard to feeding and rearing children; inspecting houses let in lodgings and tenement houses; enforcing cleanliness and preventing overcrowding; investigating the causes of the deaths of children (with the object of diminishing the altogether too high infantile mortality); inspecting workshops where women are employed; visiting the houses of outworkers; and carrying out the duties entailed by the Midwives Act and Births Act, are all duties which can be discharged with distinct advantage by the health visitor, without encroaching upon or overlapping the duties to be performed by the sanitary inspector.

I think that the legislature never contemplated that women should be designated sanitary inspectors. The London boroughs are mainly responsible for this innovation, for in order to obtain the grants sanctioned by the Local Government Board to the salaries of sanitary inspectors, women have from time to time been appointed as such, the various authorities well knowing that women were physically unable to discharge all the duties.

It is unreasonable to expect a woman to become an expert in drain laying and testing, designing and superintending structural alterations, reconstructing sanitary conveniences, condemning defective plumbers' and builders' work, inspecting canal boats, slaughter houses, offensive trades, lodging houses, etc., yet these are every day duties that fall to the lot of the sanitary inspector.

I am glad to see that The Royal Sanitary Institute has at length recognised this fact, and has instituted a special examination for women health visitors. Might we not recommend them to go a step further, and endeavour to obtain from the Local Government Board the same concession regarding salaries as at present allowed for sanitary inspectors. If this were done, women would in future be appointed as health visitors and would discharge the duties for which nature has endowed them, and much of the vexatious overlapping of duties that at present exists would disappear, and the work would be performed in perfect harmony.

I was very much surprised a few months ago to find a sanitary inspector in one of our large cities advocating that women workers in sanitary departments should receive the same salary as sanitary inspectors. He also congratulated them upon their independence in working for their own living in preference to marrying simply for the purpose of obtaining a home.

With regard to salary I certainly think that it would be unreasonable

to pay women the same rate of wages as men, for the responsibilities of the former cannot be compared with the latter. Man invariably marries, and takes a woman to share his joys and sorrows; as a natural consequence, children follow who have to be reared, clothed and educated.

I would respectfully suggest that it is the duty of a woman to marry, or how is our race to be maintained? If they evade this responsibility they must necessarily enter into competition with men for all appointments for which nature has endowed them. Their wants being few, and only having lodgings to provide instead of maintaining a home, rearing and educating a family, and the manifold expenses incidental thereto, it necessarily follows that men would be seriously handicapped, should such advice be generally acted upon.

Of course there will always be some women who from one cause or another do not marry, and for these a profession or vocation becomes necessary, but let us encourage the belief that a woman's glory should be her home, her husband, and her children.

In conclusion let me again impress upon you the advantage to be gained by all sanitary inspectors being enrolled under one banner, and becoming active members of the Incorporated Sanitary Inspectors' Association.

This Association was formed a quarter of a century ago for the promotion and interchange amongst its members of both practical and theoretical sanitary science, and the knowledge of the rights, liabilities and duties of sanitary inspectors.

During the twenty-five years of its existence the death-rate has fallen considerably, and it is only fair to claim that we have contributed in no small degree to this desirable state of affairs.

Our Association numbers about 1,400 members, in ten centres. Each centre conducts its own business in its particular district. We are also affiliated with the Sanitary Inspectors' Association of Scotland.

At the present moment we are associated with the National Association of Local Government Officers, with the object of bringing forward a Bill to secure superannuation for all Local Government officers.

As to tenure of office, the Association, in conjunction with the British Medical Association, has before Parliament a Bill with the object of securing this, and we are resolved to press it forward by every legitimate means in our power.

THE ADVANTAGE OR OTHERWISE OF APPOINTING INSPECTORS FOR SPECIAL DUTIES.

By HENRY JOHNSON,
Chief Sanitary Inspector, Wimbledon.
(ASSOCIATE.)

THE subject of which I am to open the discussion this morning is one upon which there must be considerable diversity of opinion. This is shown by the fact that in many districts a number of inspectors are appointed to discharge only specified duties, whilst even in adjoining districts each inspector is held responsible for carrying out the entire duties in the area which is allotted to him.

Our portion of the work involved in the administration of the various Acts of Parliament, By-Laws and Regulations made thereunder, and Orders of the Local Government Board, may be summarised as follows:—Drainage under Acts 1875–1890–1907 and Metropolis Local Management Acts; Scavenging and Cleansing; Common Lodging Houses; Houses Let in Lodgings; Nuisances, general; Offensive Trades; Inspection of Slaughterhouses, meat, etc.; Infectious Diseases Notification and Prevention Acts; Housing of the Working Classes Acts; Rivers Pollutions Acts; Canal Boats Acts; Food and Drugs Acts; Factory and Workshop Acts; Shop Hours Acts; Work under Dairies, Cowsheds and Milkshops Orders, etc., etc.

Taking broadly the lines that the sanitary construction of buildings in so far as drainage, water supply, etc., is concerned, and that after the building has been erected its sanitary upkeep is almost entirely in the hands of the sanitary inspector or inspector of nuisances, it would appear but right in the interests of the community that there should not be two or more sets of officers employed in the examination of its sanitary condition or of the business carried on in the building (if not a private house), excepting in cases where very extraordinary circumstances appear to justify such a departure. It would certainly appear that, without giving the fullest consideration to a recommendation to appoint special officers,

sanitary authorities have adopted such recommendation, simply following a practice existing in an adjoining or other district where the circumstances are of a totally different character, and may not justify such a course of action.

An inspector when he is appointed to office should be capable of undertaking all the duties attached to his position. In small districts one inspector with no assistants is required to discharge all the duties and work appertaining to the office. Is this not, therefore, a strong argument in favour of making each inspector responsible for the entire duties: making the size of his district such that he can efficiently cope with the work?

The point that first arises is that sanitary inspectors and inspectors of nuisances are servants of the public. They are rate paid, and whether these rates are levied direct or paid through the rentals of occupiers of properties, it is essential that the greatest possible good shall be obtained by the community for the expenses they incur in the upkeep of a sanitary staff. For the compilation of reports of the medical officer of health, or chief sanitary inspector, or inspector of nuisances, as the case may be, it is of undoubted advantage to be able to look to and to compile from the reports of one inspector the work performed in specific directions: but is the compilation or preparation of statistics of greater advantage than the more thorough and larger amount of work that can be performed by one inspector over a small area.

I will give two specific instances out of many which might be quoted:

(1) A district in London, where we will say there is a medical officer of health, a chief sanitary inspector, a number of district inspectors (the Borough being divided into a number of areas for this purpose), and in addition to these say one or perhaps two food inspectors (whose duties also include those under the Food and Drugs Acts), two or more women inspectors, and also two or more workshop inspectors.

For the purposes of consideration I will exclude one of the women inspectors, whose duties we will consider as entirely devoted to the work attaching to the Notification of Births Act of 1907, and that of visiting respecting the feeding of infants, whether attached to a milk depot (so-called) or otherwise.

We have still at least three other officers who are charged with special duties, the food inspector, and the male and female workshops inspectors. The last visits all workshops, workplaces, and factories where female labour is engaged throughout the district, and in these is often employed labour of both sexes, except in such instances as dressmaking, millinery, etc. The male officer for workshops inspects all places where male employees are

engaged, and, as already stated, these are very frequently premises in which both sexes are employed. These two officers therefore inspect the same premises.

It may, and has been known to be, a fact that both officers have visited the same works during the same day, the only difference being that the sanitary conveniences set apart for females have received the attention of the female officer, while those of the male employees have been inspected by the male officer. Is there any reason why the latter officer could not have inspected both, except one of mock modesty? There is a false impression prevailing amongst members of sanitary authorities upon the question of male *v.* female inspectors of workshops. One frequently hears it said that the female inspector can more readily obtain information from the female employees than can the male officer, but, as a matter of fact, we know it is an impossibility, and would be strongly resented by an employer of labour when conducting the inspector over his premises, either personally or by his representative, if the inspector attempted to interrogate his workpeople.

In addition to these officers appointed for special duties, there is the food inspector and the inspector for the particular district in which the premises to be inspected are situated. Both these officers are entrusted with the duty of inspecting and reporting, and, with a large staff of inspectors, it is impossible to take three or more inspectors and allocate to them the particular premises which each shall visit on certain dates.

2. I had an instance, outside London, of what may be termed over-inspection brought to my notice only a few weeks ago, by a person than whom in my experience of nearly 20 years as an inspector I have come across no one more ready to carry out any suggestion made for the sanitary improvement of his workshops, etc., or for the comfort of his employees. He mentioned that in one week his premises had been visited by the following:—One of H.M. inspectors; an inspector making house-to-house inspection; a factory and workshop inspector; the inspector of nuisances (in consequence of a complaint made by a discharged hand); and an inspector from the Mansion House council for the protection of the poor.

Although this may be said to be an exceptional case, yet I am sure it is within the knowledge of many here that such instances occur more frequently than should be. With the exception of the visit of H.M. inspector, the objects sought could have been well obtained by the visit of the inspector of nuisances, if in a small district, or if in a large district split up into small sub-districts, by the district inspector.

In addition to the officers of the local authority visiting and inspecting there are others, those of the County Council, Home Office, and private associations, and I could cite more than one instance in which three officers of the local authority have visited the same set of premises on the same date.

The bulk of the law relating to the adulteration of food is contained in the following Acts:—

The Sale of Food and Drugs Act, 1875: the Sale of Food and Drugs Amendment Act, 1879: the Margarine Act, 1887: and the Sale of Food and Drugs Act, 1899: forming a series of Statutes collectively known as The Sale of Food and Drugs Acts 1875 to 1899, conferring powers on certain local authorities for the prevention and detection of adulteration of (*a*) articles used for food or drink by man, other than drugs or water, or which ordinarily enter into or are used in the composition or preparation of human food, including flavouring matters and condiments, and (*b*) drugs, including medicine for internal or external use.

For what reasons is it considered that the duties under these Acts should be carried out by an officer specially appointed, and not by the inspector of nuisances or the district inspector? So far as I am able to gather, this practice obtains much more largely in the Metropolis than in the provinces. Throughout England, with the exception of London, where each Metropolitan borough is the local authority, the local authorities under the Food and Drugs Acts are: (*a*) The Court of Quarter Sessions for each county, now the county council: and (*b*) The town council of every borough having a separate Court of Quarter Sessions, or having under any general or local Act of Parliament or otherwise a separate police establishment.

Section 13 of the Sale of Food and Drugs Act, 1875, states that "any medical officer of health, inspector of nuisances, or inspector of weights and measures, or any inspector of a market, or any police constable under the direction and at the cost of the local authority appointing such officer, inspector, constable, or charged with the execution of the Acts, may procure any sample of food or drugs, and if he suspects the same to be adulterated submit it for analysis." As the officer authorised to take samples must be one of those mentioned in Section 13 of the Sale of Food and Drugs Act, it generally follows that the person on whom the duty falls, in all boroughs having a Court of Quarter Sessions, is the inspector of nuisances, and in counties, the inspector of weights and measures.

In London are there any reasons why a special officer should be

appointed for this duty only? Outside London, I see no reason. It is sometimes said that the district inspector becomes well known to the tradesmen and others from whom he has to take samples. This difficulty is met by the power to purchase by deputy, the usefulness of which has been immensely added to by the decision in Tyler *v.* Dairy Supply Company; this, together with the thorough knowledge which an efficient district inspector gets of the many things occurring in his district, more than compensates for any drawback through becoming known to all the tradesmen, etc., because even if one or more special officers are appointed to do this work, only a little longer time elapses before they are equally well known to the trading portion of the community.

As an illustration of the administration of the Food and Drugs Acts by a special officer as against the sanitary inspector, inspector of nuisances, or district inspector, as the case may be, let me give my own Borough, which was a large urban district, in fact, the largest in population in the county of Surrey. About three years ago it was made a borough by a charter of incorporation under the Municipal Corporations Act, 1882, but, having neither a quarter sessions court nor a separate police establishment, the Surrey County Council is the local authority charged with the execution of the Acts within the borough, subject to the following provision:—that certain specified officers can, under the direction and at the cost of the local authority appointing them, procure samples, and, if suspected of being adulterated, submit them to the public analyst for analysis, although all the costs of so doing would have to be borne by the Borough Council, and not by the County Council, the local authority under the Acts, and any penalties obtained are payable to the county fund except those in respect of margarine, where the magistrates may direct the allocation of a portion of the penalty to the authority prosecuting, but, in the absence of this direction, the penalty goes to the local authority (County Council).

Section 11 of the Margarine Act, 1887, states that any part of any penalty recovered under this Act may, if the court shall so direct (*a*) be paid to the person who proceeds for the same to reimburse him for the legal costs of obtaining the analysis and any other reasonable expenses to which the court shall consider him entitled.

The watch committee, deciding to supplement the work of the County Council, instructed me to obtain samples from time to time and have them analysed. I have no hesitation in saying that after my ten years' residence there as inspector of nuisances there are very few, if any, cowkeepers, dairymen, milksellers, or other tradesmen and dealers who do not know me well.

For the purpose of executing the Acts, the Administrative County of Surrey is divided into four districts: Wimbledon, with the following twenty-four parishes, comprising one district:—Addington, Ashstead, Banstead, Beddington, Great Bookham, Little Bookham, Carshalton, Cheam, Chessington, Coulsdon, Cuddington, Epsom, Ewell, Fetcham, Headley, Leatherhead, Merton, Mitcham, Morden, Sanderstead, Sutton, Wallington, Walton-on-the-Hill and Woodmansterne. Several of these have each a population of over 10,000.

If the system of specialising is all that its advocates claim, one might expect that I, as an official well-known to all tradesmen, etc., from whom samples have to be obtained, would fail to detect as many cases of adulteration and to secure as many convictions, as the special officer covering a large district, but the result is the opposite.

The argument I have adduced in favour of the provisions of the Sale of Food and Drugs Acts being enforced by the Inspector of Nuisances outside London, holds equally good for the Metropolitan area, as the practice invariably is for purchase to be made by deputies, and these changed as occasion arises or circumstances demand, and more especially in view of the decision of the Court of the King's Bench in the case of Tyler *v.* Dairy Supply Company (Knight's Local Government Reports, Vol. 6, No. 4, p. 442). This case is so important that, believing some may not have seen it, I set out somewhat fully the Court's judgment (see next page). From this it will be seen that it is not necessary for the inspector authorised by Section 3 of the Sale of Food and Drugs Amendment Act, 1879, to take samples personally, as he may procure such samples by agent or deputy, but he must see that the agent or deputy he employs is competent and trustworthy.

This being so, the argument for special officers doing the work under the Food and Drugs Acts falls to the ground. It is not a question of administration: it should not be one of compilation of statistics: it is a question of efficiency, and efficiency with business-like economy. Economy to the ratepayers, efficiency to all.

Therefore after much thought and some experience, both in the administration of the Act of 1875, of the London Acts, and of the by-laws and regulations in operation in the Metropolis, I am forced to the conclusion that, except in areas in which large manufacturing industries are carried on, and in which either male or female labour largely preponderates, there is no justification for the specialisation which to-day so largely obtains.

It is not economical or beneficial, internally or externally: officially, it

leads to overlapping of duties. It is irritating to the employer of labour without a corresponding reward or justice to the worker, and therefore the sanitary inspector, with the many and varied duties devolving upon him, is best if appointed and made responsible for all the duties allocated to his office in a small district or area.

In large towns and in some districts it is advantageous for a special officer to be appointed as meat inspector, unless the district inspectors possess special qualifications for the work. My firm opinion is that the efficient carrying out of the statutes with least friction, is to be ensured by making the districts smaller, and placing upon the inspector of the district the entire responsibility of carrying out all the duties which the public health statutes and the by-laws and regulations made thereunder place on a local authority, so far as they are carried out by the inspector of nuisances or the sanitary inspector.

The tendency to make special officers for special duties will, if persisted in, tend to lower the general standard. Examples of this have been seen in several professions where specialisation has become prevalent, the few have benefited at the cost of the many. The most serious point is that by any lowering of the standard the community would, in the long run, suffer.

Our aim is to see that every person desirous of becoming an inspector of nuisances or sanitary inspector, shall be so trained that he can efficiently carry out any of the duties of an inspector, or any extension to them that Parliament may make, and how can this be done better than by making every aspirant to office serve a term of years in a public health department, where he would, under the responsible officers, be given an efficient training in all branches of the work both indoor and out.

High Court of Justice.

King's Bench Division.—Tyler v. Dairy Supply Company.

1908, Feb. 10.

Adulteration—Procedure—Milk in course of delivery—Procuring of samples—Officer acting by deputy—Sale of Food and Drugs Act Amendment Act, 1879 (42 & 43 Vict. c. 30), s. 3.

An officer authorised by section 3 of the Sale of Food and Drugs Act Amendment Act, 1879, to procure samples of milk in course of delivery may procure such samples by his agent.

Case stated by justices who had dismissed an information preferred by the appellant Tyler for that he at Isleworth did procure at the place of

delivery a certain sample of milk in course of delivery by the respondent company to the Guardians of the Poor of the Brentford Union, the purchasers or consignees, in pursuance of a contract for the sale to them, and that, suspecting the same to have been sold by the respondents contrary to the provisions of the Sale of Food and Drugs Acts, 1875 to 1899, the appellant did submit the same to be analysed by the public analyst, when the same was found to have been unlawfully sold by the respondents in an altered condition contrary to the provisions of the Acts without previously having made disclosure of such alteration.

Upon the hearing the following facts were admitted or proved:—

2.—(*a*) That the appellant is an inspector under the Sale of Food and Drugs Acts duly appointed by the County Council of Middlesex for the western district of the county.

(*b*) That Robert Anderson is an assistant inspector of weights and measures acting in and for the western district of the said county appointed by resolution of the County Council.

(*c*) That on June 22nd, 1907, the said Robert Anderson (the appellant being then engaged elsewhere on other duties) took a sample at the place of delivery of milk in the course of delivery by the respondents to the Guardians of the Poor of the Brentford Union, the purchasers or consignees, in pursuance of a contract for the sale to the said Guardians of such milk.

(*d*) That the appellant in pursuance of section 3 of the Sale of Food and Drugs Act Amendment Act, 1879, submitted the sample to be analysed by the Public Analyst for the County of Middlesex. On analysis the sample, which weighed about 6 ounces, was found to contain only 2·71 per cent. of fat instead of 3 per cent., equal to a deprivation of fat to the extent of about 9 per cent.

(*e*) That the said sample taken by Robert Anderson was so taken under the instructions and direction of the appellant (but who was not then present), and that after taking the sample Robert Anderson under the same instructions and direction made a report to the appellant.

(*f*) That the information was laid and these proceedings instituted and carried on by and in the name of the appellant.

3. It was contended on behalf of the respondents that as the sample was actually taken by Robert Anderson, a duly qualified though an assistant inspector, the information ought to have been laid and these proceedings instituted and carried out by and in the name of Robert Anderson.

3. It was contended on behalf of the appellant:—

(*a*) That the sample in question had been procured by the appellant, and that Robert Anderson in taking it had acted under the instructions and directions of the appellant, and in discharge of a duty required of him by the appellant.

(*b*) That the provisions of the Sale of Food and Drugs Acts, and particularly of section 3 of the Act of 1879, had been complied with.

5. We were of opinion that the matter was one of considerable doubt, and was not covered by any decision of the Court. On the whole we came to the conclusion that as the sample was actually taken by Robert Anderson, the information ought to have been laid and the proceedings carried on

by him and in his name: that as there was a doubt in the matter the respondents ought to have the benefit of it, and we therefore dismissed the summons.

6. The question for the opinion of the Court is whether upon the above statement of facts we have come to a correct determination.

After exhaustive arguments by counsel on both sides the Court, consisting of the Lord Chief Justice (Lord Alverstone), Justices Lawrence and Sutton, allowed the appeal and sent the case back to the Magistrates to be heard on its merits.

The Lord Chief Justice in delivering judgment said:—

"After the extremely instructive arguments we have heard on both sides, I do not myself feel that we have any doubt that we ought to come to the conclusion that this prosecution was rightly instituted by Mr. Tyler. The real question in dispute is whether or not, under section 3 of the Sale of Food and Drugs Act, 1879, the inspector may procure the sample by an agent. I agree that it is important that these samples should be taken by competent people, and I agree that it is very desirable, for the reasons pointed out in the very well-reasoned judgment of the Recorder of West Bromwich in Holt v. Morris, 57 J.P. 441, that the persons who take the samples should be responsible in every sense of the word; but we should have to hold, in order to give effect to Mr. Avory's argument, that the Inspector who subsequently submits the sample to analysis and therefore takes proceedings must be the person who takes the sample; in other words, we should have to construe 'may procure at the place of delivery any sample' to mean only may take himself."

(Reprinted from Knight's Local Government Reports, Vol. 6, No. 4, p. 442).

THE DAIRIES & COWSHEDS ORDER IN RURAL DISTRICTS, AND A BETTER MILK SUPPLY.

By JOSIAH BRADLEY.
(ASSOCIATE.)

ABSTRACT.

IN an address on "The Milk Supply in Relation to County Sanitation," Dr. J. Campbell Munro, Medical Officer of Health for the County of Renfrew, stated that the sanitary administration of rural dairies had improved since 1891 at a rate out of all proportion to the improvement in the sanitary condition of towns.

A subject of this nature opens the door to other vital questions of importance, tuberculosis and infantile mortality, but I intend, as far as possible, to keep to the Dairies and Cowsheds Order and the Model Regulations of the Local Government Board. My first object is to raise a discussion on the various points in the Order and Regulations which need amendment, and secondly, to see if anything can be done to further the requirements which are necessary, if any real advance is to be made.

The Circular, Orders, and Model Regulations were made for regulating the lighting, ventilation, water supply, &c., of cowsheds and dairies, in the occupation of cowkeepers or dairymen. Although marked urban, rural districts come under the same, and on reading the first paragraph of Part I. of the Regulations it will be seen that rural districts are placed at a disadvantage in not having a proper air space fixed for cowsheds. In their circular letter the Local Government Board state that they have been asked to issue Model Regulations for the guidance of councils, and that they have prepared such regulations after receiving the report of the Royal Commission on Tuberculosis.

It appears, however, that the question of air space for cowsheds in the country was left optional, so that rural councils have no power to enforce a standard of air space in cowsheds under their jurisdiction. The Royal

Commission also drew a distinction as regards cowsheds in populous, and those in non-populous places, but gave no indication how this distinction was to be made, therefore rural councils are left to decide this question for their own localities. At the same time, any council making a regulation must submit the same to the Local Government Board, and, if in the opinion of the Board it is objectionable, they may direct that it shall not come into operation.

The result of this is, that the question of air space for cowsheds in country districts is practically a dead letter, and I think it would be much better if a standard could be fixed so as to do away with one of the difficulties which the rural inspector has to contend with. This state of things ought to be remedied, and although 800 cubic feet, as stated in Part II. of the Regulations, may be too much for country districts, it is clear that some standard should be adopted, say 600 cubic feet. The want of air space causes overcrowding, the result being increase of tuberculosis. Quite recently it was stated in the Birmingham City Council, that 100,000 gallons of milk which teem with malignant bacilli are delivered daily in the United Kingdom, and that 14 per cent. of the milk sent into Birmingham contains the infection of tuberculosis. Other large towns have a similar tale to tell. Proper ventilation of the cowsheds may be a means of checking the disease, but there are difficulties in the way of this being carried out as it ought to be.

With regard to the lighting of cowsheds the regulation is very vague, and we ought to have something more definite, say 1 in 20, or 1 in 30, or some other fixed amount which could be agreed upon as the most suitable.

In reference to cleansing, drainage, and water supply, there are many difficulties to contend with; the abominable system of farmyards (so common in country districts) which surround the outbuildings, and in many cases are so near the wells used as water supplies, ought to be remedied.

Then there is the registration of dairymen and others, which is a great stumbling block in the way of local authorities and their inspectors generally. Most of you are no doubt aware that a person may carry on the trade of cowkeeper or dairyman (providing he is not a purveyor) for the purpose of making and selling butter or cheese; or may sell milk in small quantities to his neighbours, and need not be registered. Why should not all cowsheds be registered whether milk be sold in large or small quantities, or if used for the making of butter or cheese. Unless we have some alteration of the present regulations, it will be some time before we can have a purer and better milk supply.

The Medical Officer for the City of London stated not long ago that the real method of dealing with the milk question was at the actual source, the farm, and there was no difficulty in getting this carried out on the spot by the local authority; but there are many difficulties. As previously pointed out there is no amount of air space or light fixed, the water supply is bad in some places, and there is the weak point in registration.

In conclusion, if we are to have a better milk supply, we must first see to the amendment of the Regulations; and if this conference can do anything to further the requirements necessary, let us as members do all in our power to-day, and ask The Royal Sanitary Institute to press the question forward with all possible speed.

THE HOUSING & TOWN PLANNING BILL

FROM AN INSPECTOR'S POINT OF VIEW.

By WILLIAM W. WEST,

Sanitary Inspector, Walthamstow Urban District Council.

(ASSOCIATE.)

MR. JOHN BURNS has told us that the objects of his Bill are "to secure the home healthy, the house beautiful, the town pleasant, the city dignified: to efface the Ghettos of meanness and the Alsatias of squalor." A measure which aims at securing such things starts with the approval of all good citizens, and we read it with interest to see if the nature of its provisions is such as to secure the objects indicated. One's first impression on reading the Bill through is admiration of the determination and completeness with which the author has set himself to remove well-known difficulties in the way of, and make provision for advancement towards, securing for the teeming population in our cities and towns, and the peasants in the rural districts, the urgently-needed improvements which he has aimed at.

Measures most drastic, most searching, most sweeping, are secured with a few words, in many cases by means of a few passing words of apparently little force, of which only those intimate with the object at first recognise the importance. One illustration of this may be given from section 13. At present if a house is found to be in an insanitary condition, and belongs to an unwilling owner, notice must be served, and legal proceedings undertaken which often entail prolonged delay, the occupier meanwhile having to submit to the bad conditions. Under this Bill it is made the duty of the local authority to make a closing order, and no court proceedings are necessary. It is unnecessary to recount the conditions existing which render necessary such a measure as this. So long ago as 1885, after a lengthy and exhaustive inquiry, a Royal Commission reported upon these conditions, and made suggestions for their remedy. Among their recommendations were the following:—

Local authorities should have given to them greater powers for the erection of workmen's dwellings, compulsory powers to purchase land for the purpose at fair market value, loans from Government at a lower rate of interest and for longer periods of repayment.

Attempts have been made in subsequent Acts of Parliament to provide these powers, but experience has shown their inadequacy. This is not surprising to those of us who have found the difficulty of foreseeing the interpretation which can be given to Acts of Parliament: that it required special legislation to determine that an "ashpit" meant an "ashbin," and that compulsory provision of water flush to a water closet meant also keeping such a supply when once provided.

This measure sets out, therefore, to correct this inadequacy by (*a*) making the Act compulsory instead of permissive: (*b*) giving powers for compulsory purchase of land and facilitating procedure in respect thereto: (*c*) reducing interest on loans and extending the period for repayments: (*d*) authorising the reconstruction, enlargement, or improvement of existing dwellings as well as the building of new ones: (*e*) enabling a tenant for life to provide working class dwellings: (*f*) enabling a body corporate to appropriate land for the purpose by free grant or for payment: (*g*) enabling a local governing body to deal with land in a similar way.

It may be that in the administration of these powers, means may be found by opponents for delaying or frustrating procedure, but in spite of that, the powers constitute an immense advance upon previous legislation.

Those sections of the Bill which contain the boldest, newest and most drastic provisions are probably Sections 1, 11, 13 to 17, 19, 21, 26, 27 and 32, but peculiarly, while some of the other sections are minor in their character, one at least of the important provisions is to be found hidden away amongst the so-called minor amendments in the first schedule to the Bill, which in a few words deprives an owner of any right of appeal to a Court of Summary Jurisdiction given him by Section 35 of the principal Act.

If we briefly consider those sections which I have specially mentioned we shall recognise their originality and importance.

Section 1 alters the character of Part III. of the Act of 1890 from that of an adoptive to that of a compulsory Act. This is a short section, but its importance can hardly be over estimated. Hitherto it has been found that in very many districts where the provisions of Part III. have been urgently required the Act of 1890 has not been adopted, and the conditions indicated so graphically in the report of the Royal Commission of 1885 still exist. This state of things is to last no longer, the Act *must* be put in force. Further, in some districts where Part III. has been

adopted it has not been acted upon owing to the unwillingness of the authorities to face the cost. Powers are therefore included, and advisedly so in view of the compulsory nature of the Act, which are intended to make the burden easier, and there is no doubt that attempts will be made in Parliament to make them still more easy.

Section 11 empowers the Local Government Board to enforce the carrying out of the provisions of the Act on complaint of interested persons, and that Board is given powers to order the local authority to carry out its duty, so that no loophole is left for the escape of a defaulting authority, and there is apparently no corner of the country in which in future any of the conditions whose removal is aimed at need continue.

Sections 13 to 17 are amongst the most valuable of all, and contain provisions possibly of most direct interest to sanitary inspectors. These sections may be considered as partaking more of the nature of a Public Health Act than of a Housing Act. The work done under these provisions is done under the powers given by the Public Health Acts, and is work for which the office of inspector of nuisances or sanitary inspector was specifically created by statute.

The absence of any reference to this officer in connection with his own statutory work and his inclusion in the phrase "any other officer of the authority" is unsatisfactory. If there is any officer of the local authority who should be *definitely authorised* to report, it surely should be that one who makes the inspection, who by reason of his constant employment in such investigations is able to judge the conditions, and who as a matter of fact is appointed and expected to be qualified to judge of the conditions requiring report.

Throughout the whole of the evidence and the recommendations of the Royal Commission, no suggestion is made of default on the part of inspectors in the execution of their duties. It is suggested that their numbers should be increased, and their qualifications sufficient, but their work is praised. Many of you are doubtless acquainted with the Housing Handbook, written by Alderman W. Thompson, of Richmond, a book which would of itself secure the complete fulfilment of the objects of the Bill if it were possible to place a copy of it in every household in the country. From this book I quote the following forcible and illuminating statement as to our position and of testimony to our work. In recounting the experience of Richmond leading up to the adoption and completion of their housing scheme, he says "When a too zealous inspector found it necessary to serve notices, in one form or another, on a baker's dozen of the members of the town council, including some of the most prominent members, he

quickly discovered that the majority of his employers did not appreciate his zeal, and in a short time means were found to relieve him of his duties, upon grounds that would not have been deemed sufficient for his practical dismissal had he shown less zeal or more discrimination. Thus the first attempt to secure healthy houses for the people, by proceedings under the Public Health Acts, injured the pockets of the tenants as well as of the landlords; attacked the vested interests of members of the sanitary authority itself; and effectually intimidated the sanitary inspector who took his work too seriously."

Alderman Thompson gives no information as to what became of the sanitary inspector who lost his post for doing his duty, nor does he speculate upon the effect which the "effective intimidation of the sanitary inspector" in other districts may have had upon the admistration of the Public Health Acts. The thoughtful citizen, however, who reads that sentence must have his mind directed to the possibilities of the position, and must recognise the strength of the claim which we have so long put before the government for security of tenure of office for the inspector.

In this particular case the inspector was sacrificed: in many other places, as a result of this, the public health may have been sacrificed, under previous Acts of Parliament. What reason is there to suppose that things will be different under this Act? Yet no step is taken, no effort made, to secure that this unsatisfactory state of affairs shall cease, and the inspector made safe in all districts against such irreparable wrong.

In the recent Housing Conference many speakers insisted upon the necessity of the inspector as well as other officers being secured in office, but when a resolution on the question of security of tenure was submitted, the previous question was carried, an indication of the depth of the sincerity of those attending the meeting on behalf of the objects of the Bill. One speaker pointed out the large percentage of rural medical officers and inspectors whose salaries were partly paid by the central authority, but carefully avoided saying how many of them held office for short periods, allowing them to be got rid of without dismissal at the termination of the period of their appointment. Surely we have a right to call upon the central governing body to come over and help us.

These five clauses (13 to 17) must be considered by all practical sanitarians to possess enormous possibilities, and they constitute an immense stride in nuisance removal procedure. They repeat in almost identical terms the instructions to local authorities of section 32 of the Act of 1890 and section 92 of the Public Health Act of 1875 to cause inspection of their districts to ascertain whether any house is in such a state as to be a

nuisance or injurious or dangerous to health, but they proceed to confer a new power on the authority itself to issue a closing order, without the necessity of applying to a court of summary jurisdiction, and unless appealed against to the Local Government Board within fourteen days, notice must be given to the tenant to quit, and the authority may allow him his expenses of removal, at the cost of the owner, and the house is hereupon closed until made habitable. These powers are drastic, but I am sure we agree that they are needed.

Who of us does not remember proceedings being nullified by the refusal of a bench, the members of which have no technical knowledge, to confirm the action of the local authority; or for some technicality to cause injurious delay? I know of more than one district where proceedings have been taken for closing orders, supported by the opinions of the local and the county medical officers of health, when the bench has refused to order the closing of hovels declared, by those whose duty it is to judge, to be unfit for habitation, and when there was no question of there being plenty of houses in the immediate vicinity for the tenants to move into.

Sections 19 and 20 again are two of the most far reaching in their application. They provide that any housing improvement scheme need not be actually for sanitary purposes. It may be, as Mr. Burns has laid it down, to make "the town pleasant and the city dignified."

I suppose there are few of our public men who more fully realise, or who have used greater influence to secure, especially in London in whose government he has borne so conspicuous a part, the amenities comprised in those two phrases. They are the dream of the patriotic citizen who, with admiration for what has been done elsewhere, is ambitious that his town, his birthplace, the centre of his interest, shall compare well with the best of them, and he shall be conscious in its fullest meaning of the old Roman's boast, "I am a Roman citizen," and so Mr. Burns with this ideal ever in his mind has by a stroke erased the words "for sanitary purposes" from the principal Act and opened up wide possibilities for improvement: "the most satisfactory" method of dealing with insanitary areas need not be the only effectual one, and the scheme may authorise the authority to ignore statutes, byelaws, regulations, or any other provisions under whatever authority made, and no further Parliamentary authority is required. The author of the Bill evidently intends that no legal quibbles shall stand in the way of the "town pleasant."

Under the provisions of the principal Act, local authorities were prohibited from carrying out an improvement scheme themselves, and they have often been handicapped by inability to arrange for the work being

done. By section 21, however, this disability is removed and they are authorised to carry the scheme into execution themselves.

So important and valuable are the clauses to which reference has already been made that it is difficult to find stronger words to apply to those we find as we proceed, and the need for which we feel in connection with sections 26 and 27.

The principal Act implies the habitable condition at the time of letting of any dwelling let to the working classes, and the owner may be held accountable for any default in that respect. These new sections carry this implication very much farther and in the direction which sanitary inspectors have often urged that it should go.

We have long insisted that the man who sold watered milk or tainted meat was often less culpable than the house owner who let an insanitary house: that there was a moral responsibility, which ought to be made a legal one, for the wholesomeness of the dwelling, and that it was the owner's duty to take all possible means to ascertain if there were any insanitary conditions which he ought to remedy.

At the time of the passing of the Public Health Act of 1875 the responsibilities of the state to its citizens, the interest of the state in the well-being of the individual, were only beginning to be generally recognised, and the Act was drawn without anticipation of the difficulties and delays which have since been found to be possible in the remedy of the conditions existing by legal procedure. Present day thought, however, is much in advance of this position. It is now a hackneyed phrase to say that property has duties as well as privileges. We insist that if an owner has a house from which he desires to draw an income it should be one which is fit for a human being to occupy, and that he cannot be allowed to enjoy the privilege of making a profit out of the necessities of the people for housing without accepting at the same time responsibility for the sanitary condition of the house he desires to let.

Under the Public Health Acts the owner is only responsible when he has disobeyed a notice from the sanitary authority to put his house in order. Now the fact of its being out of order is the default, and makes it his duty as well as interest to keep himself acquainted with the state of affairs. This is a masterly and ingenious compliance with one of the recommendations of the Royal Commission of 1895, that the number of sanitary inspectors should be increased. Every owner of small property is made a sanitary inspector by Act of Parliament.

In the principal Act, with the Poor Rate Collection Act, 1869, the expression "houses for working classes" is defined as houses let at £8 or

less per annum. This Bill extends the limit to include houses of double the value, so that houses or parts of houses in the rural districts rented at not more than £16 per annum will be brought within this very valuable provision.

This is well, but I think most of us will agree that better would be the extension of limit recommended by the Conference on Housing, held in London in May last, namely, to include houses of not exceeding £40 rental in London, and £26 elsewhere. It would also be of service to the occupier if the possibility of the landlord contracting out of his liabilities to the tenant under this section were done away with.

Critics of this measure have pointed out that a great deal of the work of the Bill is done under references to Acts of Parliament already in force, and objections have been raised to it on this account.

The criticism is well founded, as examination shows that, though the Bill contains only sixty-one sections, reference is made to twelve existing Acts, in several cases repeatedly, and to about sixty sections, sub-sections, paragraphs, and schedules in those Acts. The references and cross-references no doubt entail some trouble when we wish to ascertain the extent and details of its powers and procedure; but I find that they do not confuse or hinder the objects aimed at or the methods by which they are to be obtained, nor do they increase the difficulties of future codification, so that to one who is in sympathy with those objects the question of legislation by reference is a minor defect which in no way vitiates the measure.

Objection has also been raised to the great powers given by the Bill to the Local Government Board, but I am unable to see good grounds for the objection.

The Bill contemplates vast improvements in the housing conditions of the working classes especially, and the intention of course is that the objects desired shall be reached. The Act is to be compulsory upon local authorities, and experience has shown the need for some authority to guide and enforce, and it seems to me that the Local Government Board is the proper authority to do this, especially as there is a proposition to form a special department for this purpose. In all previous Acts of a similar kind the Board is the central supervising authority, and there would appear to be no reason why the earnest sanitarian, at any rate, need take objection to final supervisory powers being given to the Board, after both district and county councils have failed.

A CRITICISM OF THE HOUSING BILL.

By PETER FYFE,

Chief Sanitary Inspector, Glasgow.

FOR many years I have been deeply interested in the adequate and proper housing of the working classes. The second city of the kingdom has long been striving for an adequate solution of this problem. Nowhere in the country has the administrative mind been more anxiously awaiting light and leading upon it. In these circumstances, I am glad to be afforded an opportunity to discuss the long-expected measure now laid before Parliament by the President of the English Local Government Board.

I will not give a description of the Bill. I assume that the sanitary inspectors of the country have read it, have compared its terms with the Principal Act, and have sought to interpret its meaning by a careful study of the references it continually makes in Part I. to various previous enactments. My object is to offer critical remarks upon it, in the hope that not only ourselves, but Members of Parliament who will be asked to agree to its terms (without having the advantage we possess of constant personal touch with the working classes), may see some of the weak points.

The first part of the Bill deals mainly with dishousing and rehousing: the second part with the planning of new townships on fresh sites.

For the dishousing of a too congested population from insanitary dwellings, the starting lever, old and rusty from much disuse and the inroads of time, is that of the 1890 Act. The useless mainspring behind the lever is not to be replaced by something better. Sections 30 and 31 of the Principal Act are not to be repealed. As the lever which controls the steam to a locomotive or other engine is an all-important part of the machinery, so the lever of this dishousing machinery should be, in its composition and connections, of the best material, and direct in its action. By section 30, the lever to be used in starting the dishousing operations is the medical officer of health. It is still to remain his duty to represent to the local authority any dwelling-house which *appears to*

him to be in a state so dangerous or injurious to health as to be unfit for human habitation.

Let us assume that this official, under a vast burden of other work, is fit to undertake such an amount of inspection (for, in solemnly certifying in such language, the work must be *personal*). In the following section (32) provision is made against his laxity. If the lever for the duty is sufficient (and it ought to be), why should it need the impulse of a mainspring of four or more householders to remind him in writing that they, the complainers, know of dwelling-houses contiguous to them, so dangerous or injurious to health that they ought to be closed?

Two practical considerations need to be weighed here, in order to estimate the value of this starting machinery. Firstly, I am not aware, in all my experience, of the existence of these "four or more householders." Like other myths, they only exist in some one's imagination, in this case, of those who drafted the Principal Act, not but that there are plenty of people who are ready to complain of what annoys them personally, but they rarely act in combination; and, moreover, they would require, by some means, to gain access to other people's houses in order to ascertain the actual conditions of which they complain. I have known of individuals so complaining, but have not unseldom found they were contiguous proprietors, who were, naturally, seeking for a demolition which would improve the amenity of their own property.

Now, in the light of these remarks, let us look at *clause 13 (1)* of the Bill. It re-enacts, with certain amendments, section 32 of the Act of 1890. Here it is declared to be the duty of the local authority to see that their medical officer of health does his duty, and on his representation, or that of *any officer* in their service, or on information given by any other person that dwelling-houses are unfit for human habitation, they may take certain action.

The idea working in the mind of the draughtsman both of the old section 32 and of the new clause 13 (1) is difficult to understand. The words "*or of any officer of the authority*" introduce another lever for the purpose of starting the legal machinery. This other lever has no name. It may be a policeman, a road surveyor, a lighting or water inspector, or a sanitary inspector. Each of them seems to have the power to suggest the need for action to a local authority. The local authority may, however, safely ignore any representation from such. It is only when complaints originate with four or more contiguous householders that the authority may be compelled to move, through the representation of the medical

officer of health, and then only by this quadruple-householder mainspring pressing upon the Local Government Board for an inquiry, if they elect to do nothing. Thus four householders have more compelling power than any medical officer of health, so far as making their complaints effective is concerned, and their complaints are made of greater consequence than the representations of any officer of the local authority.

I have shown that it is very unlikely that the "four householders" will ever trouble themselves in the business, notwithstanding the powers placed in their hands; nor will that nebulous entity "any officer" think it worth while to make a representation which may promptly be relegated to the local authority's wastepaper basket. Thus, in practice, the Bill, if passed as it stands, will result in one official performing the inspecting and representing part of the work; and, even then, the local authority may, if they see fit, disregard his representation, unless he can command the services of the aforesaid complaining householders. It is a beautiful example of an enactment providing the means of how not to do it, or of doing it very leisurely, if a local authority be so minded.

Complaint has, again and again, been made throughout the country as to the number of local authorities who have done little or nothing under the Housing Acts, and yet, when a chance occurs to improve the machinery and to put the levers and springs of action into effective working order, the old, inefficient procedure is once more to be adopted.

Perhaps no body of trained men are so intimately acquainted with the terrible conditions amid which the labouring classes continue to dwell as the sanitary inspectors of the country (going continually in and out among this class of the population, knowing and seeing every insanitary detail, the damp walls, the rotten woodwork, the decaying and broken plaster, the leaking roofs, the want of ventilation and light, and the miry and filth-sodden surroundings), and yet these, the statutory officers under the Public Health Acts for the discovery and removal of nuisances, are not once alluded to in the Bill. They have no statutory duty to report to their authorities upon dwellings unfit for habitation. It may be presumed they are classed under the words "any officer"; but it is an old and true saying that everybody's business is nobody's business.

Local authorities anxious to do their work and face their responsibilities make use, I know, of their sanitary officers in the detection of dwellings unfit for human habitation. I have been utilised in this way many times, and doubtless many of the officers I am addressing have done much valuable work in this direction. Without their reports and repre-

sentations on this subject, the housing of the people would be a great deal worse than it is at the present time.

Supine local authorities, on the other hand, have ground for excuse if they elect to let the law take its inexpeditious course, and await the inspection and formal certificate of their medical officer of health; as what is the statutory duty of an otherwise very busy official, and only his, cannot be considered by the legislature to be one of very great importance or urgency.

I claim that it should be the statutory duty of the sanitary inspector as well as that of the medical officer of health to report to the local authority upon any uninhabitable houses in his district: nay, I go further, and aver that any Minister of State who was sincerely anxious to clear the country of the wretched hovels in which too many of its poorer inhabitants are dwelling, would not neglect the present opportunity to utilise to the full the services of those, than whom none are more intimately acquainted with the circumstances and necessities of the case.

But I have another serious objection to this clause as it stands. A certificate that a house is in such a state as to be "dangerous or injurious to health" is behind the times. Nuisances at one time had so to be certified before legal action could be taken to abate them: to-day both statute and common-sense declare that an ordinary sanitary nuisance need not be proved "dangerous or injurious to health" to be summarily put down. There are many houses unfit for human habitation, in the modern sense, regarding which, to swear they were "dangerous or injurious to health" would be impossible to any man with an unstretchable conscience. Again and again we have lost cases in Glasgow through medical gentlemen going into the box and conscientiously swearing that rotten-looking dwelling-houses were neither dangerous nor injurious to the health of the tenants. We do not know much of the health of our forefathers, the Troglodytes, nor of our contemporaries, the Lapps; but in the caves of the former, as in the snow-huts and wooden "njallas" of the latter, those people appear to have been able to rear up a hardy and surviving race.

Clause 27 of the Bill itself forms a curious commentary upon the antiquated and dangerous verbiage of clause 13. It lays upon all landlords who contract to let houses for habitation by persons of the working classes, the responsibility of seeing that their houses, during the holding by the tenants, shall be kept "*in all respects* reasonably fit for human habitation."

Now, the landlord's responsibility under clause 27 only extends, for Scotland, to houses rented at £8 per annum, or about 3s. 1d. per week. All workmen's dwellings above that small rental are outside the clause. The working men of the country will be able to understand from this how the Bill will help them. As a matter of fact, the clause will be of no use but to a limited number, and those the very poorest, who cannot afford to pay more for their dwelling than the sum I have named, as that is the class of house which is defined and specified in clause 26. To make the Bill a really effective one for our working classes, as against a careless and indifferent landlord, the rental qualification should be raised to not less than £24 a year, or 9s. 2d. a week, which is a common rent for dwellings for the working classes of this country.

Coming back to *clause 13*, let us try to see the difference between a house so "dangerous or injurious to health as to be unfit for human occupation," and a house not "in all respects fit for human occupation." You will notice the difficulty of proving the former statement. It is only in cases of extreme dilapidation, dampness, and disrepair that a certificate could be issued against any house, which could not be met by a counter medical certificate that the house was *not* dangerous or injurious to health.

There are houses standing and occupied to-day in Glasgow, and I doubt not in every large town in the Kingdom, which have been so certified by the medical officer of health, and which are a reproach to the community, but which cannot be closed because of the words I complain of in this clause. The case would be different if we had only to prove they were "not in all respects fit for human occupation."

Take the house rotten, blistered, and cracked in the plaster, so that proper cleansing of the walls and ceilings is impossible: and the flooring boards so worn and gaping in the joints that the floor cannot be washed without the water soaking down into the deafening beneath. There are hundreds of these in every town, which ought to be closed by order until the owners renewed plaster and flooring. They have little else wrong with them, and many of them, under the care of poor but cleanly-disposed tenants (who often put paper over the rotten plaster), look fair in appearance to the superficial observer. They, under a degraded tenancy, would quickly become "dangerous or injurious to health," but the clean tenant saves a certifiable house from certification: it might easily become, but is not presently, in her keeping, a house "dangerous and injurious to health." I have seen such houses so full of cracks and fissures that vermin, in warm weather, find nesting-places which would

defy the most strenuous efforts (short of stripping the whole plaster) to eradicate them.

A true Housing Bill should be an instrument in the hands of local authorities which would enable them to bring working men's dwelling-houses up to a reasonable occupation standard without the need to ask a medical officer of health to stretch his conscience to such an extreme point as clause 13 makes him do. To do this is, and has been, to court defeat; and in Scotland this will continue, as the case against the house has to be proved before a sheriff. In England, the Local Government Board may cast proof overboard, and take the evidence of its own inspectors in every disputed case; but this also is a dangerous path to tread. It puts a power to close property, independently of proof as to whether it is injurious to health, into the hands of the Board, which in due time will bring its own Nemesis.

Properly enough, the owner is, after being served by the local authority with a closing Order, entitled to put his house into a habitable condition, or he may appeal to the Local Government Board if in England, and to the sheriff if in Scotland, against the Order. The clause does not make it clear whether the Order to close is to take effect prior to the result of the appeal; if not, then past experience shews that during the interregnum between the date of the Order and the final decision of the Board, the tenants will have to suffer all the inconvenience incidental to tradesmen working in the houses, in order to get them ready for the official inspection. This is sometimes very great, and, when wet plaster-work forms part of the repair, must have injurious effects on the inmates, and especially on the children.

In every case where the repairs required are extensive the tenants should be temporarily removed, and the compensation paid to them which is referred to in *sub-clause (4) of clause 13*.

I now pass to *clause 15*, dealing with "charging orders." It refers one back to section 36 of the Principal Act. It looks quite in order that any owner who has been at considerable outlay of capital to put his property into a thoroughly habitable state should be able to get from the local authority a "charging order," or, in other words, a certificate that he has, as matter of fact, spent a certain amount of money in repairing it; but in view of the great diversity of both legal and lay opinion as to the policy of a local authority giving an owner any information in detail, either as to what is complained of in respect of his property, or as to what he must do to make it, in their opinion, habitable, the clause leaves the whole subject in obscurity.

When is such a "charging order" exigible? When we turn to section 36 of the Principal Act we find these words in sub-section (1):—

> "When any owner has completed, in respect of any dwelling-house, any works *required to be executed by an order of a local authority* under this part of this Act, he may apply to the local authority for a charging order."

This seems to pre-suppose that, in issuing their Closing Order, the local authority shall, unless they think the property cannot be made habitable by repairing, require certain works to be executed. There are, however, no words in the Bill making this compulsory on local authorities, consequently they do not consider they ought to specify anything with regard to the property, nor make any requirement upon the owner, but simply to close it. If this is the intention of the legislature they should not leave it ambiguous, as in the Bill in clauses 13 and 14, and then in clause 15 by reference to section 36 of the Act, making a charging order forthcoming upon the supposition that local authorities will do something, which they will not do unless under statutory requirement.

It is not quite an honest policy. A man might spend £500 upon his property rather than have it closed, but, unless it was spent in terms of section 36 of the Principal Act (*i.e.*, on "works required to be executed by an order of a local authority") he would not be entitled to receive any charging order.

With regard to *clause 17*, a question arises as to whether the restriction it puts upon the power of courts of summary jurisdiction in certain cases to extend the time allowed for the execution of repairs upon a building or for its demolition, will apply to Scotland notwithstanding *sub-clause (13) of clause 44*, which substitutes the sheriff for the Local Government Board. If it only applies in England I have nothing further to say; but as the sheriff court in Scotland, in which such appeals will be heard, is a court of summary jurisdiction, it seems to me Scotland should be specially exempted from the operation of this clause.

Clause 20 will raise some complicated questions. It is an amendment of an amendment upon the procedure necessary upon a local authority deciding to go in for an improvement or reconstruction scheme requiring a compulsory purchase of land. It proposes to cut away sub-sections (*a*) and (*b*) of section 5 of the Act of 1903, which itself is an amendment of section 1 (sub-section 4) of the Principal Act. It appears to mean that, when the Local Government Board have once issued an order sanctioning a reconstruction scheme under Part I., section 8, or under section 39 of Part II., and has authorised the compulsory purchase of land or buildings for the scheme, a local authority need not be hampered by all the circum-

locutory processes required by the above-recited sections, under which it had to go to Parliament for confirmation of the scheme.

The clause, however, does not appear to affect sub-sections (4), (5), (6), and (7) of section 38 of the Principal Act, which deal with the compulsory purchase of land or building sites under the Lands Clauses Acts. Now, it will be noticed that sub-section (5) of section 32 of the Principal Act, dealing with obstructive buildings (which is not to be repealed), provides:—

> "The owner of the lands may, within one month after notice to purchase the same is served upon him, declare that he desires to retain the site of the obstructive building, and undertake either to pull down or to permit the local authority to pull down the obstructive building, and in such case the owner *shall retain the site* and shall receive compensation from the local authority for the pulling down of the obstructive building."

As, under the succeeding section, the local authority may, through an order of the Local Government Board, acquire this site by compulsory purchase under the Lands Clauses Acts, a local authority has two inquiries to face, in the event of a proprietor desiring to retain a site he cannot adequately utilise, and which may be compulsorily taken from him. It means (in Scotland, at any rate) first, a fight before the sheriff, before the obstructive building is removed, and, if the proprietor or proprietors choose, another fight later on, on the question of the value of a site to be compulsorily purchased, regarding which the proprietor or proprietors have averred their wish to retain it for their own purposes.

Perhaps nothing has delayed the removal of obstructive buildings in large cities so much as this power of pre-emption which owners can exercise with regard to the sites of obstructive buildings. If this were taken away, and a local authority could at one and the same time remove objectionable buildings and acquire the sites on which they stand, without being put to the expense of a double inquiry, a great advantage would be gained. Section 20 simplifies one part, but leaves the complication and expense incidental to section 38 (5) as they were.

Clause 21 should have a rider attached to it, to the effect that it would only be the duty of the local authority to exercise the power given in Part I. of the Principal Act where it was proved to be necessary, and when they had not, under a private Bill or Provisional Order, obtained somewhat similar powers. They should be left at liberty, as formerly, to apply for an improvement measure of their own, in lieu of adopting the powers given in the General Acts.

I have no doubt that many local authorities in the country will express

serious objections to *clause 23*. It gives the Local Government Board a roving commission to send an officer or inspector where they choose, to make an inspection or hold an inquiry. No complaint by twelve or four householders or any others is necessary. The arbitrary *ipse dixit* of the Board is all that is needful to put any local authority on its trial, and whether convicted of a lapse of duty or not, they must bear all the expense of the inquiry. I anticipate, when the Bill comes before the House, considerable amendment will be made upon this clause.

I have already, in referring to clause 13, had something to say on *clause 27*. It puzzles the simple Scotch mind. The word "landlord" is defined as a person who lets a working-man a dwelling-house "*under any contract*." As distinguished from this person there is the "*owner*," who, in English parlance, is called "the owner for the time being" or the "rack-renter," as defined in the Public Health Act, 1875. If the landlord chooses not to make a formal contract in the matter I presume the clause will not apply. To the Scotch mind it looks a curious piece of legal machinery. In my view it ought not to matter in the slightest whether houses built for habitation by the working classes were built and let under a specific contract or not. It should be sufficient that the working classes inhabit them from year to year, in which case, contract or no contract, the dwellings should be presumed to be "reasonably fit for human habitation." If they are not so, and not made so as expeditiously as may be by the owners thereof (whether these be landlords or not), the local authority should be entitled to step in without being required to prove under clause 13 that the dwellings are in such a state as to be "dangerous or injurious to health." In any case, the low rental specified in clause 26 (before referred to) makes the benefits to be derived from the clauses delusive; and, in view of the higher rents charged for workmen's dwellings of two or three apartments, places the clause in the category of those pretentious but inadequate efforts to ameliorate the housing conditions of our working classes above the lowest.

In *clause 34* it is proposed that Parliament shall grant to the Local Government Board power to compel any two or more local authorities to act jointly for any purpose of the Housing Acts, either generally or in any special case. It was probably foreseen by the President of the Local Government Board that, unless assurance could be had that the area to be dealt with in connection with a town-planning scheme would, when the scheme was finally completed, fail to be administered and supervised in all respects by the principal undertaking local authority, little or nothing

would be done. Manifestly, no urban local authority would willingly interest itself financially or otherwise in such a scheme unless on the distinct understanding that the citizens of the new area are to be *de facto* its own citizens. I see nothing in the Bill providing for this.

Any city or town that might undertake town-planning or suburb-planning in respect of an extensive area on its borders, *but under county administration*, for all the Bill provides, may find, after its work was concluded, that it had to face a fierce parliamentary opposition before Committees of both Houses for the acquisition of the new territory; consequently the Board are, in this clause, to be empowered, if they think it expedient, to compel the burgh and county to joint action. This compulsitor by the Board is to have the same weight as a Provisional Order obtained under section 279 of the Public Health Act of 1875 for the formation of a united district; but, unlike the Act, the Bill does not contain an excepting clause such as is provided in section 286 for urban districts. This section of the Public Health Act exempts burghs containing a population of twenty-five thousand and upwards, which are not to be included in any union-of-district scheme without their consent.

It hardly needs argument to prove that it is on the margin of large and congested cities that housing or town-planning schemes are most required, or that it is the working classes in such centres that are in most urgent want of good housing, fresh air, and abundant sunlight: nor need I occupy time showing that such large industrial populations can most economically and effectually provide the water-supplies, sewerage, scavenging, and lighting so essential for a fresh communal life. Now, they are not going to plan out any fresh urban area in their vicinity, and supply its inhabitants with these things, except under a statutory guarantee that the township (composed probably, for most part, of their own citizens) is to be part and parcel of the city.

An amendment, therefore, of clauses *34* and *46 (3)* is necessary, in the interests of all large towns. They must either be specially exempted, as in section 286 of the Public Health Act, or a clause should be inserted in the Bill placing the newly acquired land to be built upon, if not within the municipal area, under their jurisdiction and administration.

Probably the county authorities will object to this, and will desire, when all is completed, to be left in a position to oppose to their utmost annexation of the new valuable area. The President of the Board will have to choose his course. The antagonism is there, and it will not be minimised by any proposals for enforced action such as is laid down in clause 34. No one can deny that cities must continue to expand,

and it is equally certain that this expansion ought to proceed on the main lines of Part II. of this Bill, but the Bill itself ought clearly to set forth with whom the responsiblity of administration is to rest, if the acquired area is coterminous with the existing boundaries of the town. A joint administration in such a case is unthinkable.

Not a few cities are already severely hampered in their natural growth by the accumulation round them of small communities, each working out its communal salvation upon lines of least financial resistance, either independently or as county units. This, of course, means the minimum of burghal machinery consistent with a fair amount of comfort and convenience. Any system which would add to these, whether independently or jointly administered, could not expect the support of the cities and large towns of the Kingdom.

These criticisms upon Part I. of the Bill have left me no time in which to review Part II., dealing with town-planning as such. A great deal might be said upon this portion of the measure, both appreciative and adversely critical; but I must defer any further remarks upon it.

From what I have stated, you will have gathered my opinion upon three important points in this important measure:—

Firstly, that the Bill is unjust to the great and influential body of public servants known throughout the kingdom as *Sanitary Inspectors*, who do so much laborious duty daily in connection with the very work it is intended to promote;

Secondly, that the working classes, above the very poorest class, who pay the humble 3s. 1d. per week or thereby, will not have the advantage they might reasonably claim from such a measure (that is, the assurance that the landlords or owners of their houses shall be bound to maintain them in all respects in a state fit for habitation); and

Thirdly, that local authorities, particularly in England, are placed by the Bill at the mercy of the Local Government Board and their inspecting officers, without any opportunity to appeal against their decisions.

OFFICE AND DUTIES OF A SANITARY INSPECTOR.

By T. W. WARREN, Cert.R.San.I., R.P.C.,
Chief Sanitary Inspector, Cardiff.

THE first Public Health Act was passed in 1848, and it requires the appointment, amongst other officers, of an inspector of nuisances.

The principal Acts of Parliament under which the sanitary inspector, or inspector of nuisances, performs the major part of his work and under which he is appointed by the local authority are, for England and Wales, apart from the Metropolis, the Public Health Act, 1875, in which he is called an inspector of nuisances, and for the metropolis the Public Health (London) Act, 1891, in which he is termed a sanitary inspector.

The sections of these Acts relating to his appointment provide for a fit and proper person. Every urban authority may make regulations with respect to the duties and conduct of the officers and servants so appointed or employed.

It would appear that an urban authority may only appoint one inspector of nuisances, whereas a rural authority may appoint one or more, but many urban authorities have assistant sanitary inspectors under the inspector of nuisances. Many smaller authorities appoint the surveyor to the office of inspector of nuisances, and this is often done with the object of obtaining part of the salary from the county council of the county in which their district is situated, in some cases making the salary of the inspector of nuisances more than that of the surveyor, and thus the authority obtains half the larger sum from the county, though the work as surveyor takes the greater portion of the officer's time.

The sanitary inspector must obey and carry out the instructions and directions of the sanitary authority, and those of the medical officer of health, of the district, or without their instructions, carry out the duties imposed upon him by the Public Health Act, 1875, or by the Public Health (London) Act, 1891, by any other statute or statutes, or by the Local Government Orders or Regulations, which relate to his office.

Qualifications.

The sanitary inspector requires a technical knowledge of all matters bearing upon sanitation. He should be conversant with the Acts of Parliament which relate to public health, and the by-laws and regulations in force in the district, more especially those relating to the abatement of nuisances and to sanitation.

He should be able to draw, so that he can make sketches by which he will be able to better explain some matters in his reports. He should be able to work out the floor space and cubic contents of rooms of any shape, as this is necessary in cases of overcrowding of dwelling houses, common lodging houses, canal boats, etc.

He must have a knowledge of all insanitary conditions which are likely to injuriously affect the health of persons in dwelling houses. He should understand the principles of ordinary ventilation and the usual methods of applying them to buildings, also the conditions which cause dampness and dry rot in houses and the methods of preventing same. He must have a thorough knowledge of house drainage, and of the method of testing drains. He must be able to supervise the work in carrying out good drainage, and to advise owners as to the best sanitary fittings and appliances.

He should be acquainted with the requirements in cowsheds, dairies, slaughter-houses, as to paving, lighting, ventilation, cleansing, water supply, air space, and drainage. For bakehouses he should be acquainted with the law as to cleansing, sleeping, drainage, etc. He should have a knowledge of the nuisances caused by offensive trades, and of the by-laws regulating them, so that he may be able to deal with any contravention of such by-laws. He should know what constitutes a smoke nuisance, and what methods to adopt to abate it.

The sanitary inspector should have a thorough knowledge of the law and regulations relating to infectious diseases, the proper means of isolating infected persons, the best method of disinfection, and the best disinfectant to use in reference to the particular object requiring disinfection, and of the removal of infected persons to hospital.

The Local Government Board has arranged a conjoint board of examiners to hold examinations for sanitary inspectors, and to grant certificates to those passing such examinations. Those seeking metropolitan appointments must obtain this certificate. But that of The Royal Sanitary Institute remains a sufficient qualification for those seeking appointments outside the metropolis.

Power of Entry.

The sanitary inspector should have some written document, properly authenticated by the sanitary authority, showing his official position: otherwise, if he is not in uniform, persons may reasonably refuse to believe that he is a public official and deny him entry to the premises.

The Public Health Act, 1875, and the Public Health (London) Act, 1891, give power of entry to the sanitary authority or their officers into any premises for the purpose of examining as to the existence of any nuisances thereon, between the hours of 9 a.m. and 6 p.m. outside the metropolis, and between the hours of 6 a.m. and 9 p.m. within the metropolis.

It is the duty of every local authority to cause to be made, from time to time, inspection of their district, to ascertain what nuisances exist requiring abatement, and to cause such nuisances to be abated: also to enforce the provision of any Act in force within their district requiring fireplaces and furnaces to consume their own smoke. Where a nuisance has been ascertained to exist, or an order of abatement made, the inspector shall be admitted from time to time between the hours above mentioned until such nuisance is abated.

If admission to any premises is refused for the purpose of examination, any justice upon complaint on oath by the sanitary inspector (provided reasonable notice in writing has been given to the person having custody of the premises to admit the sanitary authority or their officers) may, by order under his hand, require the person having custody of the premises during the hours aforesaid to admit the sanitary authority or their officers: and if no such person can be found, the justice shall on oath made before him of that fact, by order under his hand authorise the sanitary authority or any of their officers to enter such premises during the hours aforesaid. The order shall continue in force until the nuisance is abated. Such an order will always be granted if the evidence can be adduced of (*a*) the existence of a nuisance, (*b*) reasonable grounds for suspecting the existence of a nuisance.

It will be noticed that a sanitary inspector has no power to force an entry. He may enter an open door, but in any case permission to inspect should first be politely requested. It is seldom necessary to take advantage of the provisions of the Act which enables him to inspect compulsorily. Under section 41 of the Public Health Act, 1875, powers are given to enter premises for the purpose of examination of drains, waterclosets, earthclosets, privies, ashpits, or cesspools; but there must be a written

complaint to the sanitary authority stating that any of the above things on, or belonging to, any premises within the district is a nuisance or injurious to health. On receiving such written complaint the sanitary authority may by writing empower their officer to enter such premises after twenty-four hours' written notice to the occupier, or, in case of emergency, without such notice; and the officer may cause the ground to be opened up for the proper examination of any drain, watercloset, earth-closet, privy, ashpit, or cesspool. If no defects are found, the local authority must make good any damage done at their own expense; but if defects are found, then the local authority shall cause notice to be given to the owner or occupier of the premises, requiring him forthwith, or within reasonable time, to carry out the necessary work specified on the notice. If such notice is not complied with, the person to whom it is given shall be liable to a penalty not exceeding ten shillings for every day during which he continues to make default, and the local authority may, if they think fit, execute such work and recover the expenses in a summary manner.

Manner of Making Inspections.

The sanitary inspector should have regard to the manner in which he conducts himself when making inspections. He should treat everyone with proper courtesy and politeness.

If to enter permission is refused and he has reason to believe his inspection of the premises is necessary he can generally obtain a magistrate's order to enter, but if he asks in a proper manner to be admitted, and, if required to do so, shows his written authority (which should bear the seal of the sanitary authority) he will seldom be refused admittance: in fact, as a rule, he will find the tenants volunteer information which will be of use in his inspections.

Where he receives complaint from the tenants he should never furnish their names to the owners of the property: if he does so the tenant, if a poor one, may get notice to quit, and in the future the inspector will have opposition from the occupiers instead of their assistance.

In making inspection of premises where there is infectious disease, he should show proper sympathy and give all information he can as to the best means of isolating the patient, and the means to be adopted to prevent the spread of the disease in the house.

He should never pass any remarks, or appear to notice anything he sees which does not concern him, for people resent any interference in

their private affairs, and do not like to think the inspector is prying on them. He should not participate in or encourage any bad feeling which may exist between neighbours.

He should, as soon as possible, attend to all complaints received, whether written or verbal, and any nuisance which requires abatement should receive immediate attention. On receiving a written complaint, he should at once acknowledge the receipt of it, and undertake to see to it with as little delay as possible. He should then enter the complaint into the complaint-book, and also the date of its receipt. If the nuisance or matter complained of does not come under the nuisances with which he can deal, he should so inform the person complaining, as there are nuisances which are not injurious to health, and can be dealt with otherwise than by Public Health legislation.

He will find that he will receive many anonymous letters, which often do not deserve to be noticed, as in many cases they are written to spite someone by persons who are ashamed or afraid of making known their identity. But yet there are persons, more especially poor tenants, who are afraid that if their landlord knew they had complained to the sanitary inspector they would receive notice to quit; many landlords threaten their tenants to act in this way, therefore it is as well for the sanitary inspector to always see for himself if there are any grounds for the anonymous complaints received.

DECISION OF COUNCIL ON RESOLUTION PASSED AT THE CARDIFF CONGRESS, 1908.

Resolution passed in the Conference on the Hygiene of School Life:—

> "That the Conference on School Hygiene strongly recommend that the paper by Dr. F. Rose (Educational Adviser to the L.C.C. Education Department) on 'The use of Spray Baths in Elementary Schools' be printed with illustrations and certain additions as to the cost of installations, and circulated among all the educational authorities of the country."

Decided to approve this resolution, and to circulate the paper by Dr. Rose among Educational Authorities, after it has appeared in the Journal of the Institute.

[*The Proceedings of the Congress will be continued on page 753.*]

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CONGRESS AT CARDIFF.

CONFERENCE OF WOMEN ON HYGIENE.

SANITATION BY WOMEN.

By MRS. EDWIN SEWARD.

THE science of sanitation, of good health, is one before all others about which there should not be any sort of mystery or of hidden knowledge, in its leading principles. Its main lines are easily perceived, easily understood and easily remembered; their general meaning, having nothing of the occult in them, may be summed up as fresh air, light, and cleanliness. Nature has given us each of these in the widest plenty. She always goes a long way of her own accord in starting these principles rightly, but it is in our misguided applications of them to the concerns of mankind that difficulties have always begun.

There can be no reason why women should not be first among those who are to promote the simple and sound principles of sanitation: whether for the advantage of great sections of people, and therefore through public influences, or by less noticeable opportunities arising within the individual home. It is there at any rate, in the ordinary dwelling, that women will find their efforts very usefully exercised.

There is so much advocacy just now of the open window at all hours and seasons, that some enthusiasms from the long-past cult of the zealous fire-worshipper seem to have been taken to by the present-day devotee of unlimited fresh air. And there are times when rheumatic joints or stiff necks go far towards declaring that though the quality of the dose of fresh air may be of the best, the method of its application is too crude. Yet the air of an ordinary room under usual conditions requires to be constantly changed in some way that will not lower the temperature too

suddenly, nor bring in the rush of outer air so strongly as to create draughts, causing many personal discomforts, and even dangers. This is one of the most ordinary difficulties met with.

A very simple remedy is that of opening the windows widely, if only for a few minutes, whenever the room is vacated. But this involves the trouble which most people do not like, and the thoughtfulness they forget to cultivate; or it admits rain and wind, to say nothing of dust, smells, or noises. Thus the systematic opening of windows finds the usual pathway of good intentions, and the old-fashioned dislike of fresh air remains nearly as wide-spread as it was a century ago. In small houses of the artizan class this is the prevailing position of matters in spite of all that the children of the house may be told in their schools about sanitation. As to country cottages (often thought to be elysiums of fresh air and healthfulness) the aversion to air in the form of draughts from badly-made doors or leaky windows often begets a state of atmosphere of permanent and respectable antiquity, as old as the cottage itself. It may be remembered indeed, that a German lady writing a few years ago on the beauty of rural England, recognised how good and fresh the country might be if it were not for the usual country cottage!

Sometimes special openings in the walls to admit fresh air, and others to emit vitiated air from rooms are provided, but how often they fail! The keenness of a winter frost, or the blustering of a cold wind, leads to their being closed or stopped up; besides, a sufficient number of them become expensive in the building of an ordinary house. And so this small matter, simple as it seems, remains an important trouble to those who are really careful about having the home as healthy as fresh air can make it.

The best remedy is the obvious one of using the windows properly. If they are sash windows they should have the bottom frame unusually deep, so that it may be open when thrown up and down, at the middle meeting rail only. If casements, the best form is to hinge them, not at the side as usual, but a few inches away from it on a pivot, so that both the front and back of the casement admit an inch or two of air. If such windows are kept from being closed, except for extreme necessity, the room will thereby have a better healthfulness.

As to the admission of light into houses, considering our sparse three months or so of summer, it might be thought that for the rest of the year at any rate, people would leave the sun to his own chances of looking in as often as he pleased. But then, he will fade their best carpet, or the wall paper! So the requisite curtain or two, for use in strong summer sunshine, becomes a voluminous pall-like mass, descending from the ceiling until it

sweeps and lies upon the floor, a continuing trap for dust and smoke and insects. Even if there are windows enough to get this blessing of good daylight into the house there are often curtains of a kind to turn light into the gloom which covers a multitude of both odours and dust. A few light iron rods with small curtains for each separate window, removed and replaced in a moment, are the things necessary and no more.

Everything should be easily removeable. Carpets should always have the rug form, leaving the skirting and adjoining floor bare. Linoleum or oilcloth should never be nailed in position, and, even if loose, it should be turned up every week for an hour to avoid chance of damp to the underside from the washing of the surfaces. The healthiest form of floor treatment is that of leaving a wide space uncovered, but stained of a pleasant brown tint; when the colour has dried into the grain, a coating of beeswax and turpentine should be forced into the wood with a good sized hot laundry iron, covered with flannel. The wood thus absorbs the colour and the wax, and with a little renewing at times, it retains an excellent wearable and permanent finish.

A wish often expressed is that for plenty of cupboards built into a house. One can readily sympathise with and understand it, but it may easily be bad sanitation where recesses in walls are covered in by doors, and the insides loaded up by clothes and similar contents. Often when this is done they are so placed that cleaning the interiors is difficult, and ventilating them is impossible; therefore, moveable cupboards and wardrobes are often to be preferred, so that both backs and fronts can be well dusted and cleaned, and the air, if only for a short time, allowed to play freely round them. In any event a fair number of holes for ventilation should be put into the lower and upper portions of cupboards, whether fixed or removeable, and the best of health agencies, fresh air, will find its own way for the freshening of all contents.

Permanently open fittings should always prevail in the arrangement of sinks, lavatories, baths and closets. The old-fashioned wooden panelling around such features is now almost discarded, and the more they are clear, distinct and unconnected with the walls, skirtings and floors, the better for the important need of keeping them clean with the smallest amount of attention.

On the subject of baths, it is often found difficult on account of expense to provide small cottage houses with bathrooms. A very useful method having the merit of economy, is that of placing an enamelled iron bath in the scullery, in a position which easily allows of hot water from the kitchen fireplace or scullery boiler being poured into it. The cost of

range-boiler, hot or cold supply piping, etc., is avoided, and if a light screen or curtain is provided there need be no inconvenience in its use. Even the smallest of houses can contain such a low-priced bath arrangement as this, and it is hardly going too far to hope that by some legal method it could be included for every house as a requisite condition, just as a sufficient amount of open space and efficient drainage are demanded by the authorities dealing with approval of buildings.

In another direction, those of us who know something of the working of the National Society for the Prevention of Cruelty to Children would earnestly desire to see the use of a further domestic fitting made really compulsory. I allude to the necessity for fireguards. Even adults in various conditions of physical or mental ill-health are found to be in some danger owing to the non-use of fire-guards. But the terrible injury to thoughtless and defenceless children in this country is appalling. In any well populated district of the poorer classes (certainly about South Wales) the newspapers almost any day yield painful accounts of terrible suffering and distress by child-burning.

The helpless little creatures, very young to be left alone, stand too near the fire, stumble against it or play with it, often rushing away at once and fanning the flames in their clothes. More than once I have seen a little child in a cot at the Cardiff Infirmary—taken there after such an accident—lying so still and quiet in the swathe of cotton-wool which covers its terrible burns, that it needs no nurse or doctor to give the ominous shake of the head which bespeaks a hopeless case. It has been shown that in this country, and in only one year, more than 1,500 cases of child-burning owing to lack of fireguards, have been registered.

Whilst infectious diseases, especially of children, are to be compulsorily registered; whilst public and private offences against the recognised laws of sound sanitation can be legally punished, these frequent and terrible accidents—the result of causes so often preventable—should also be made culpable; in fact the provision of fireguards should be compulsory. This could easily be done by requiring that an iron wire-guard should be an integral part of every firegrate sent out for use in cottage houses, just as the bars of the grate or the oven-doors are requisite parts of it.

The care of persons unwittingly exposed to disease is the recognised work of those whose watchword is good sanitation. Surely then, the daily peril of little children and others: their exposure to fearful maiming, shock, and actual death, by fire, is an evil which well becomes a professed body of sanitarians to include in their list of enemies to the well-being of the community. Therefore, is it too much to hope that this Congress,

especially the women members of it, should recognise by Resolution the necessity of supporting the provisions of the Children's Bill now before Parliament, and which also contains provisions for the growing loss of infant life by crowding infants into adults' beds, thus leading to their deaths by over-laying. This occasion is opportune, and it is to be expected that a representation from this assembly might have all due weight. The subject is one upon which women (whatever other claims they may at present be putting forward), might speak with a voice of authority, of charity, and of Christian-like helpfulness.

I have made reference to the compulsory principle. Therefore I should be glad to offer an appreciation of methods by which something more than an exact laying down of the law (no matter how just and necessary that may be) is possible in matters which touch domestic sanitation.

In more than one of our populous cities a few ladies may be heard of who find some part of their occupation in calling at the homes of women of the class who try (even though ignorantly and without method) to keep their children in good health. Such ladies can convey some general understanding of true health principles, and may thus do worthy work in extending that simple knowledge which may keep disease and decadence out of many a home. They may thus aid in promoting that happiness and prosperity which are the good fruit growing out of the culture of sanitation.

Miss Mabel Shickle *read a paper on "Home and Infant Management Training for the Woman Worker."*

Miss L. M. Morgan *read a Paper on "Hygiene in its relation to the Nursing of the Sick Poor in their own Homes."*

Miss Hester Davies *read a paper on "Food and Cookery."*

INFLUENCE OF PARENTAGE UPON INFANTILE MORTALITY.

By MISS ERIE EVANS, M.B.Lond.

THE significance of the present high rate of infantile mortality cannot be appreciated unless considered in relation to the birth-rate and death-rate of the whole population.

By infantile mortality rate is meant the proportion of infant deaths under twelve months to 1,000 births.

The birth-rate has been falling steadily since 1876, when it was 36·3 per 1,000, and in 1907 reached 26·3 per 1000 of the population at all ages (*cf.* Registrar General's Summary Report, p. V.) This is the lowest birth-rate on record in this country.

It has been argued that a falling birth-rate is desirable, inasmuch as it is accompanied by a falling death-rate. But it has been pointed out that this is only a passing phase due to the decline in the birth-rate leading to a larger proportion of deaths at ages of low mortality, and that if the birth-rate continues to decline this must in time lead to a larger proportion of aged persons who give a high death-rate (*cf.* Dr. Walford's Report on Infantile Mortality, 1907). This has been the experience of France (*cf.* McCleary, Infantile Mortality, footnote, p. 6). It is on this account that the high infantile mortality rate, combined with a falling birth-rate, is of national importance.

During the five years 1876–1880 the infant mortality rate was 145. It rose until during the years 1896–1900 it was 156. Since 1899, when it stood at 163, it has dropped, though in 1904 it rose again to 145 (*cf.* Registrar General's Report, 1906, pp. XXXIX., XL.) Last year it reached the low figure of 116, the lowest figure on record in this country. This decrease is, however, less satisfactory when we learn from the Registrar General that it was due mainly to the wet and cool summer "which checked the rise in the rate of infantile mortality which usually occurs at that period of the year." This customary rise is due to diarrhœal disease.

In discussing the influence of parentage upon infantile mortality there are many factors to be considered.

1. *Nationality.*—Comparing various countries they are found to stand in the following order, starting with those having the highest rates of

infantile mortality: Russia, Hungary, Prussia, Italy, France, Japan, *England and Wales*, Switzerland, Denmark, *Scotland*, Australia, *Ireland*, Sweden, Norway, New Zealand (*cf.* Newman, Infant Mortality p. 328). New Zealand has reached the low rate of 80, as compared with 150 for England and Wales and 272 for Russia.

If various races living together, in crowded areas of large towns, be compared, it is found that Jews, Italians, Scotch and Irish have a lower mortality than the English. This however is probably due only indirectly to difference of race, the immediate cause being the fact that the parents among these races care for their infants to a greater extent than do the English living in the same districts (*cf.* Newman, Infant Mortality, p. 225; George R. Sims, The Black Stain, p. 130). This better care involves not only breast-feeding, probably the most important factor of all, but also greater cleanliness, etc.

2. *The Occupation of Mothers.*—Much emphasis has been laid upon the evil of employing married women in factories, and factory work has been made responsible for the heavy death-rate from prematurity and immaturity. In the Registrar General's Report, 1906, p. 14, we find the following data for 1896–1905:—

Lancashire (many women employed), infantile mortality rate	171
Glamorganshire (few women employed)...	167
Durham (ditto)	164
West Riding (many women employed)	158

In Preston and Blackburn, where the employment of women is declining, the infant mortality has been rising since 1891; and in Durham and S. Wales, where women are little employed, the infant mortality is rising; whereas in the West Riding, where women are much employed, the infant mortality is falling (compare Newsholme, Vital Statistics, p. 127: Newman, Infant Mortality, p. 137).

It seems, therefore, that the employment of women is not the cause of high infantile mortality, but that both result from a common cause, and are therefore often found together. This common cause is probably the crowding of dense masses of population without means of support, leading to poor food, clothing, and housing. This is suggested by the higher proportion of infant deaths from diarrhœa in urban districts (compare Newman, Infant Mortality, pp. 174, 197) "All diseases of infancy are heavier in the towns than the counties, but immaturity is twice as fatal and epidemic diarrhœa seven times as fatal in the towns."

A few mothers work away from home from choice, but these are a small proportion: the great majority go to work of necessity, because

their husband's wages will not meet the needs of the family. To prohibit the women from working in factories must therefore lead to poorer feeding and poorer housing, or force the mother to undertake work other than factory work which may be heavier and more badly paid. Any of these results would lead to higher infant mortality.

3. *Age Incidence of Marriage.*—The mortality of children appears lowest when the mothers are between 30 and 35 years, greatest when they are under 20, and gradually increasing when they are over 35, though even then lower than when between 20 and 30 years of age. The influence of age of the father appears to act in the same direction. Inasmuch, however, as the higher age incidence of marriage is usually found among those having greatest sense of responsibility, it is possible that this factor may have greater influence than that of age (*cf.* Newsholme, Vital Statistics, p. 129).

4. *Mental Development of the Parents.*—Illiteracy, measured by the inability to sign their name, is more marked in women than in men in large towns and less marked than in men in agricultural counties. Among the 22 counties with lowest infantile mortality (1891–1900) one only, Hereford, had more than 30 per 1,000 illiterate married women, the highest being Monmouth with 64 per 1,000 (*cf.* Newman, Infant Mortality, p. 222).

The question of illiteracy is a factor probably entering largely into the high infantile mortality rates of industrial areas. The ignorance of mothers in the science and art of mothering far exceeds the indication given by the inability to sign their names. Dr. Milson Rhodes asked fifty mill girls how they would feed a baby three months old deprived of its mother. One said cow's milk, one said milk and water, while the remaining forty-eight were entirely wrong.

The importance of mental development in the mother is illustrated in other ways. It is not merely a question of her knowledge of facts. That the mental state of the nursing mother may affect the health of the infant has been demonstrated by Paul Budin (*cf.* The Nursling, p. 89).

5. *Alcoholism in the Parents.*—The average number of children to each married woman admitted to reformatories under the Inebriates Act during 1905 and 1906 was 5·3 (*cf.* Report of Inspector under Inebriates Act, p. 52). If this be compared with the legitimate birth-rate calculated on the married female population, aged 15–45 years, in England and Wales during 1906, which was 222 per 1,000 (*cf.* Registrar-General's Report, 1906, p. XXIII.), it is seen that a most undesirable fertility exists among the inmates of reformatories. The child-mortality rate among these children of inebriates was 45·4 per cent., as compared with an infant

mortality rate of 13 per cent. for England and Wales during the same period. The ages when the children of inebriates died is not given, but it appears clear that their death-rate is abnormally high.

These results may be compared with those of Dr. Sullivan in an investigation upon chronic female drunkards in the Liverpool Prison who had borne children. After excluding all cases complicated by other degenerative factors (*cf.* Newman, Infant Mortality, p. 72), the average number of children to each one of 120 such women was five. He compared these cases, where possible, with sober branches of the same family, with the result that 21 drunken mothers were found to have had an average of 5·95 children each, while 28 sober mothers of the same families had an average of 4·89. The child mortality under two years for drunken mothers was 55·2 per cent. and for sober mothers 23·9 per cent.

It has been shown that alcoholism leads to physical deterioration in the child before birth, acting through the mother, as well as after birth through the environment of which it is the cause, whether the offender be father or mother (*cf.* Newman, Infant Mortality, p. 72). If this fact be taken in conjunction with the high birth-rate among inebriates, as indicated by the above figures, the high death-rate among their children must be regarded as a preventive against racial degeneracy.

Illegitimacy.—The birth-rate of illegitimate children, though it gradually fell from 1857 to 1900, has been stationary since, while the birth-rate of legitimate children has continued to fall (*cf.* Registrar General's Report, 1906, p. 5).

Infantile mortality from all causes in 1906 amounted to 261·35 per 1,000 among illegitimate children as compared with 129·13 among legitimate children (*cf.* Registrar General's Report, 1906, p. CXXX.) It appears further, from the same report, that of the excess of deaths in illegitimate children, a larger proportion is due to prematurity and immaturity than to diarrhœa, and that a greater proportion is due to atrophy, debility, marasmus, etc., *i.e.*, to immaturity than to prematurity. Among legitimate children, on the other hand, more deaths are reported due to prematurity than to immaturity (*cf.* Newman, Infant Mortality, p. 211). This difference between legitimate and illegitimate children is more noticeable when London only is taken (*cf.* Report of Interdepartmental Committee on Physical Deterioration, 1904, Vol. I., p. 137).

These figures indicate that the high mortality among illegitimate children is due to prenatal causes rather than to environment, and if so, all remedies directed to lessening mortality among such infants tend to racial degeneracy. An exact comparison cannot be made owing to the difficulty

in differentiating wasting due to immaturity from wasting due to neglect. In either case, however, it is an indication of inferior parentage.

Prostitution.—Dr. Sanger (*cf.* History of Prostitution, p. 477) states that as a result of answers obtained from 2,000 prostitutes in New York it was found that 947 had 1,917 children. One single woman gave birth to as many as ten children. Of the total 1,917 children 1,090 were illegitimate. There were more than six deaths to every ten children born as compared with one and three-quarters to every ten children under five years for the whole of New York during three years.

The causes of death among these children of prostitutes is not given, but the proportion of deaths due to immaturity is probably greater even than in the case of illegitimate children as a whole. Illegitimacy may be dissociated from prostitution particularly in rural districts, and in rural districts illegitimacy may be found associated with a low rate of infantile mortality (*cf.* Newman, Infant Mortality, footnote, p. 25). It seems probable, therefore, that the high infantile mortality among illegitimate children is largely attributable to prostitution, and that here especially it acts as a preventive against racial degeneracy.

In order to judge of the relative importance of various causes of infantile mortality we may compare the proportion of deaths due to diarrhœal diseases, respiratory diseases, wasting diseases, etc. (*cf.* Newman Infant Mortality, p. 47: Registrar General's Report, 1906, p. CXVII.) The two great causes are wasting diseases and diarrhœal diseases. The former occur chiefly before the third month and the latter chiefly after the third month. The former are due chiefly to prenatal conditions, resulting in prematurity and immaturity, while the latter are due to conditions of environment. The former represent the infants which are born unfit to survive. As these so far exceed the deaths from any other single group of causes, and as we have found that deaths from immaturity predominate, particularly among illegitimate children and children of inebriates, it appears that if a satisfactory reduction is to be made in the rate of infantile mortality the advisability of allowing freedom to the criminal and inebriate classes must be considered.

While it is urgently necessary that the questions of better housing, better milk supply, the economic position of mothers, and the education of mothers should receive immediate attention, it is also necessary to realize that while criminals, inebriates, and the feeble-minded continue to propagate, successful efforts in lowering the death-rate among children of such parents must lead to racial degeneracy.

THE INDUSTRIAL ASPECT OF TUBERCULOSIS.

By DR. JANE WALKER.

ABSTRACT.

IN the modern treatment of consumption there is of necessity a great deal of loafing. All people who are experienced in the open-air method of treating this disease, and who are acquainted with all that that term comprises, are agreed as to the necessity of keeping patients at rest while in the acute stage of their illness, that is to say, that while they have fever and those signs of disease in their lungs whereby a practised observer knows that the mischief is progressing instead of being quiescent or subsiding, they must be left absolutely at rest. And so great is the influence of mind over body, that it often happens that, until a patient realizes this rule without exception, he does not make any advance towards recovery.

Moreover, it is a truism, that Nature abhors a vacuum, and therefore that the mind must be filled with something. The old rhyme, "Satan finds some mischief still for idle hands to do" is strictly true of the poor consumptive, and I am clear from my own observation that those institutions where the work question is for various reasons not made into a prominent part of the treatment have more trouble with their patients, and have to exert more supervision over them, than those institutions where work is an important factor in the daily routine. I make this statement with less hesitation because I have worked on both lines, and I have no doubt whatever that the difficulties of the non-working days exceeded by far those of the present system, where every one does some work or other except the absolutely bedridden and those who are acutely ill.

It is, however, by no means an easy matter to induce people to work—they feel slack and not up to the mark, and it is far easier and pleasanter for them just to sit in a chair and do nothing or to walk aimlessly along the lanes; to get a patient beyond this stage is one of the hardest parts of a sanatorium medical officer's duties. The patient probably thinks he is being put to work for the advantage of the sanatorium. He is in most institutions either paying for himself or being paid for by someone else, and the sum of money, although it represents in a quite inadequate way the

cost of his treatment, seems to him a fortune which should keep him in slothful ease. Then whatever work he is put to do would be better done by someone else, so that the task of making the unwilling worker work and the unwilling employer employ him is no light matter, and is somewhat like rolling a heavy stone uphill. Still it has to be done, or the sanatorium treatment of consumption in the poor must remain an acknowledged failure. This is not only from a social, but also purely from the medical aspect of the case, for one very great factor in the cure of consumption is time.

It often happens that an early case loses its signs in a comparatively short space of time: he has gained weight, and feels, and to the inexperienced observer seems quite well. But unless he has had some preliminary testing time of work before leaving, he is more than likely to break down again and to bring discredit on this method of treating the disease. If he is to return to work involving muscular exertion, it is imperative that he should have done some hard muscular work under supervision. We are not doing our duty by such a patient, or by the society which has sent him, if we allow him to leave while his muscles are flabby and before he is able to undertake a full day's hard work without more than the normal amount of fatigue. Then, too, he has been more highly fed (and rightly, to enable him to starve out his disease) than he will be on his return to his ordinary surroundings, and before he leaves he should be fed as far as possible as he will be fed when he goes back home. This he will probably withstand, thinking you are trying to make something out of him, but be as patient as you can, and explain the reasons to him. Do not rest till you have made him realise that he must remain and work under supervision till you consider him fit to be discharged.

The first work that any patient should be put to do should be something for the community. Therefore, women should lay the table, make their own beds, help with dusting and sweeping, and wash up and tidy in the pantry. Men should peel potatoes, clean knives, wait at table, clear away things from table, make their own beds and clean their own boots. The best way is once a week, on a certain day, to divide up the various tasks to certain patients who keep them for that week and then are put to a different task the following week.

These smaller and more general tasks being successfully accomplished without consequent ill effects the next ones are floor polishing and digging. Floor polishing, besides being of utility to the community, is of the greatest help to the muscular development of the patient, and thus is an occupation of great value and generally much appreciated. It is less monotonous than

digging, of which patients often complain, but which in its turn is useful from the point of view of physical development. The rule is that these tasks are performed for two hours each day as part of the general treatment, and when they are satisfactorily accomplished the question of what to do next has to be considered. Some patients have to leave at this point, they would lose their place, or their money is at an end, and so forth. And some of these can resume their work with a certain degree of safety. But a certain number are not fit to return to work under ordinary conditions and without supervision. My plan is to keep them on at half-fees as working patients. These people live in a cottage, one for men and one for women, and come over to the sanatorium for their meals and general supervision.

The principal occupations for them are gardening, carpentering, lace-making, and dressmaking; and as soon as they are strong enough to work efficiently more than two hours a day they begin to earn a little money. Our industrial development has been exceedingly satisfactory; the men and women have worked very well, they have greatly improved in health, and a fair number of them have got situations as gardeners, stewards, and so forth on leaving the sanatorium.

But a large proportion of those who are fit to work desire to remain on in our neighbourhood, either doing work on their own account or kept on in our employment; and for a long time we have been considering what occupation would enable us to give really lucrative employment to a considerable number of ex-patients.

French gardening seems to be the solution, and we have accordingly begun the plan of having two French experts over from France to teach us. That scheme is now in full swing. French gardening involves less heavy work than the usual English plan of cultivation: it is therefore more suited to delicate people. It consists in intensive cultivation under bell jars (cloches) which are light and easy to lift, and under frames that can be easily lifted by two people from place to place.

There is endless work in shifting the bell jars and frames, watering, shading from the sun with mats made for this purpose, and all of this can be done after some instruction by delicate people with some intelligence. In addition to the gardening operations, workers will be required to make the mats. The carpenters' shop will be busily employed in making frames and glazing the lights and in mending and repairing these things. Some workers will be required for packing, one of the most important details of the whole scheme, on which success or failure so much depends, and patients of intelligence will be required for correspondence and account

keeping. When the whole scheme is fully at work about thirty people will be permanently employed and in receipt of a living wage. There will also be some system of profit sharing, whereby it will be to the interest of everyone to put their best work into the concern.

The question of work for consumptives after they are convalescent has up till now been one of the great difficulties, but we are confident that the solution lies in the method sketched out above. Work that they can do and that is well paid opens up a vista of satisfactory remunerative employment unknown except to the limited few. This plan, moreover, is helpful to the great problem of returning the people to the land. On all hands, therefore, it should commend itself as a valuable contribution to the study of social economies.

Mrs. Herbert Ashburner, B.A. *(the Hon. Secretary) read a paper on "Ladies' Public Health Society of Manchester and Salford."*

This Society has now been at work for forty-seven years.

Its objects are:—

1. The giving of instruction in the matter of the feeding and the care of infants.
2. The regular visitation of the houses in the districts.
3. The giving of instruction in cases of infectious diseases, including cases of consumption.
4. The distributing of leaflets on sanitary subjects, and the supplying of lime and whitewash brushes.

The members of the society make it a rule to avoid almsgiving as far as may be. Their object is to help people to help themselves.

The members of the society have always held it a part of their work to aid in the beginning of similar work in other towns. The list of places to which they have gone to lecture on the work of their society is very long.

The point to be emphasized in health work is, that the teaching must be friendly in character. In short, there must constantly be kept in mind the direction that "A Health Visitor should act as the friend rather than the inspector of the people."

Miss Olive M. May *read a paper on "Hygienic Dress for Women and Children."*

CONGRESS AT CARDIFF.

CONFERENCE ON THE HYGIENE OF SCHOOL LIFE.

SORTING & GROUPING OF CHILDREN FOR EDUCATIONAL PURPOSES.

By C. J. THOMAS, M.B., B.Sc., D.P.H.,
Assistant Medical Officer (Education) to the London County Council.
(MEMBER.)

WITH universal medical inspection in future greater stock will be taken of individual differences of children. This must lead to reorganisation of methods, especially in the direction of adapting curricula to special types. It is therefore opportune to catalogue the present nature and extent of special arrangements, and to try whether we can see a little way ahead.

I purpose in the first place to deal with the grouping of children without regard to these individual differences, and then to pass on to the sorting of children requiring special treatment. The most urgent matter in school organisation requiring reform is the size of classes. The maximum size of the classroom is limited by the physiological powers of the teacher and scholars and by considerations of hygiene; the number of occupants is further determined by hygienic considerations. Even under the most favourable circumstances, we must fix the maximum size of classes as 48 according to these criteria. In practice the maximum size is determined by the regulation which allows a certificated teacher 60 children, but further permits an habitual excess of 15 per cent; so that classes of 70 are often found. That the Board of Education is alive to the harm done to the mental and physical well-being of teachers and children by these large, unmanageable, and overcrowded classes is shown by the recent abolition of the lower limit of 8 sq. ft. per child, which allowed conditions of the utmost danger to exist. In an investigation upon the spread of measles in schools, I found that, whereas in well-ordered schools on the 10 feet basis the spread of measles followed laws which

admitted of control, in overcrowded departments upon the lower basis the characteristic outbreak was an explosion rendering control impossible. The Board refer in their last report to the "much needed reduction of the inflated classes that are as yet one of the most serious obstacles to the efficiency of elementary schools." The children in ordinary schools are classified according to age, sex, size, and mental capacity.

The Classification by Age.—It is necessary, perhaps, to touch upon the lower age limit. Social conditions in certain areas make the admission of children below the compulsory school age imperative, however much epidemiologists may deplore this. Where needful, the babies should have special arrangements and treatment suited to their tender age. It would be excellent if the person in charge had nursing experience. The advantage of having such a person upon the staff, whom the head teacher could consult in emergencies relating to health, would be great.

One particular age grouping, which is the result of the system of grants in vogue, leads to a considerable amount of over-pressure and damage to health. This is the hurrying of children out of the infant into senior departments. While an infant the grant allowed is 17s., but immediately on entering Standard I. it jumps to 23s.; a great deal of pressure is put upon infant teachers to prepare children for Standard I. as early as possible. Soon after the sixth birthday many a child is drafted into Standard I. whose mental growth has been slow; many children returning convalescent from zymotic disease, and consequently backward, are pressed on at the very time when much mental activity is undesirable. I have frequently seen nervous disorders such as night terrors, spasmodic tics, and infantile neurasthenia set up by this over-pressure.

Here are the notes of a recent case resulting from a similar age classification in an older child:—A girl, A. B., said to be twelve years old, was seen in March, 1908, on account of aberrations of manner and speech. She had been ten months in her present school. The teacher reported that she talked to herself in class; that she had wandered from home recently from 9 a.m. to 7 p.m., and that she required special watching. Furthermore, the facial expression had coarsened rapidly; a year ago she was normal in all respects.

The mother told me the child was only ten years of age (so that the teacher had made a mistake of two years), and had been in Standard IV. in the previous school. At her present school she had been put, owing to this mistake, in Standard VI. The mother stated she obtained no rest at night, shouting about school; she mistook articles of furniture for classmates and talked to them.

On examination she was in a neurotic condition: she hesitated in answering simple questions, meeting one with a scared expression; her memory for recent events was poor. I concluded she was suffering from over-pressure and recommended exclusion from school for two months. Seen again in June she was quite normal and intelligent, her memory restored and her expression engaging and frank. She was directed to return to school but to a lower standard.

The Classification according to Sex.—In day schools older boys and girls should be educated apart. At eleven years the curve of growth of the sexes begins to diverge both physically and mentally: the internal proportions of desks suitable to either sex are different, the occupations and interests appealing to boys and girls begin to differ. The arguments adduced for continued co-education, however valid they may be with regard to residential schools, do not apply to day schools. However small the school, an attempt should be made at differentiation in the older standards.

The Classification according to Size.—The bare idea of this is sufficient to raise a smile. But examining an elementary school in the absence of the scholars one would imagine this was the normal method. Even where three sizes of desks are supplied it is rare indeed to find more than one size in any particular classroom, although in Standard III. the range of age is from 8 to 14, and in Standard IV. from 9 to 14; and the stature of the children varies 18 inches. It is not infrequent for some classification according to size to be practised, children being placed in standards above their mental capacity because they are so big.

The Classification according to Mental Capacity and Physiological Powers.—No special provision for abnormal children was made by the Act of 1870. Compulsory education had not long been in force before it was seen that a considerable proportion of children required special treatment. The most obvious are the blind and deaf. Together they number 1 in 1,000 of all children. Prior to the passing of the Elementary Education (Blind and Deaf Children) Act of 1893, the provision made for them was unsatisfactory (as the name of the older institutions, "asylum," shows). In regard to both blind and deaf, residential treatment in general is to be preferred: it is only in very populous areas that sufficient children can be brought together in day schools for proper classification.

The Blind.—The School Board for London determined in 1872 to provide teaching for the blind. This provision was made under great difficulties: there was no legal power to spend money upon special arrangements. Furthermore there was no experience available, and for twenty years the work was entirely experimental, for instance, the best

kind of reading type had not been worked out: in 1890 the School Board brought the unsatisfactory state of things that existed with regard to the Blind and Deaf to the notice of the Board of Education, and received recognition of the classes for grant. Meanwhile the Royal Commission on the Blind, the Deaf and Dumb, etc., had been appointed in 1885 and reported in 1899. At this time Cardiff shared with three other centres in England and Wales (London, Bradford, and Sunderland) the honour of having commenced classes for the blind.

The Act of 1893 repealed the powers of the guardians and made the education of the blind and deaf obligatory upon all education authorities. Much progress has been made since. The Commission reported in favour of blind children spending a large part of their time in ordinary schools. In London this was carried out until, in 1901, the younger children instead of passing half their time in the ordinary schools were taught entirely in blind schools, although older children continued to attend ordinary schools. The practice has now entirely fallen into desuetude.

The Act defines blind as "unable to read the ordinary type used in elementary schools." This brings a number of semi-blind children into blind schools. These, sitting side by side with the others, introduce many practical difficulties: they use their remnant of eyesight to the utmost, and it is very difficult to develop their sense of touch to the same degree as totally blind children. It would be better to classify the blind still further into totally blind and partially-sighted. According to the regulations of the Board of Education the average attendance at a blind class should not exceed 15: 15 square ft. per child must be provided, and single desks should be the rule.

One of the difficult problems relating to classification in day schools has been solved in London by the progressive reduction in number of schools from 26 in 1893 to 6 at present, the children travelling longer distances or being boarded out: the mentally defective blind taken into a residential institution, and separate institutions for the older boys and girls established.

High Myopes.—The provision of suitable education for these children has proved difficult. Since it is advisable for them to exercise their accommodation to a minimum extent, ordinary school work is inadmissible. There is a considerable number of them in London. One child seen this week (June, 1908) brought a hospital card upon which was printed "Unfit for school any more at all." Such a sentence if carried out precludes a child from any form of training. Special classes are necessary where the work should be largely oral and manual, pens, paper and reading books

banished, and visual symbols only worked with at arm's length upon blackboards. The London Education Committee has approved the establishment of such a centre.

The Deaf.—The definition of deafness given in the Act is "too deaf to be taught in a class of hearing children in an ordinary school." This definition has led to difficulty in classifying the children. It may be taken that a child who cannot hear the standard whisper at four feet is educationally deaf.

As in the case of the blind, things were most unsatisfactory until the passing of the Act of 1893. For over a century there had been two competing methods. The manual system, which is much easier and quicker in producing results, long held the field except in Germany. The first class for the deaf and dumb in London in 1874 was taught upon the manual system, and it is only of recent years that the oral system has had a fair trial. Even the Royal Commission was unable satisfactorily to settle the point. The reasons for the apparent failure of the oral system, at first, were the adverse influence of children lodged in homes where communication was made by signs; the advanced age of the pupils when they came under instruction; and the admixture in the classes of those who could with those who could not benefit by the method.

These conditions have been changed. The Stainer homes in London were closed. The Commission originally recommended the age of entry as seven years, and the Act fixed it as such. Valuable years were thus lost. This has now been altered, and the age of entry is five. Coming at this age, surprising progress is made. The submission of all children to the medical officer for an opinion as to fitness for oral instruction, coupled with the institution of a home for those unable to pursue the oral method, has removed the third adverse influence. At present the pure oral system is producing results amongst the greatest triumphs of human patience and intelligence. By it the deaf are restored to natural communication with their kind, and the production arrested of a deaf variety of the human race which the segregation and consequent intermarriage produced by the sign language threatened.

The first question, therefore, after the decision of educational deafness, is the suitability of the child for oral instruction. About 10 per cent. of the deaf prove unsuitable for this method, and should be strictly segregated. Older boys and girls should be drafted into separate institutions.

The next classes of children for whom special treatment was recognised as necessary were the defective and epileptic.

The Feeble-minded.—There is a proportion of children, varying from one to two per cent. of the whole, incapable through mental defect of profiting by the instruction given, and whose presence in the ordinary school is undesirable.

The Royal Commission on the Blind and Deaf took these into consideration. In their report of 1899 they recommended that "feeble-minded children should be separated from ordinary scholars in public elementary schools in order that they may receive special instruction, and that the attention of school authorities be particularly directed towards this object."

No legislation followed, however. But London and Leicester share the credit of having established special classes in 1892. The method followed was not that of classes attached to the ordinary schools, but the separate school system already in operation in Germany. The Board of Education sanctioned these schools, allowing them to rank as infant schools for grant. Until legislation was carried out, however, things were unsatisfactory. A Departmental Committee was appointed, which reported in 1898. The following year the Elementary Education (Defective and Epileptic Children) Act was passed. This differed from the Blind and Deaf Act in being adoptive instead of compulsory. Already there were 2,015 children attending special schools in London, at the present time (1908), there are 6,544 children, either attending or passed for attendance at schools for the feeble-minded, totalling rather more than ·9 per cent. of the whole.

The size of classes is limited by the Board of Education to 20 children with 15 feet of floor space. The regulations also require a minimum of 6 hours a week devoted to manual work; in practice it is found that good results are only obtained when considerably more time is given. This is not due to the powers of touch and muscular sense being less impaired than the other senses in these children, for this is not the case. It is beginning to be recognised that this is the rational method of education of all children of elementary school age, and should be extended to all. But while results can be obtained from methods falling short of the best with ordinary children, the rational method alone can lead to improvement in the feeble-minded.

The examination for admission into special schools requires care; the medical officer conducting it must be approved by the Board of Education; the examination must be carried out at a time and place notified beforehand to the Board, and the parent must have the opportunity of being present. Careful notes must be taken, since a medical certificate in each case must be signed and transmitted to the Board, and the certifying officer must be prepared to support his opinion in court. The decision is sometimes

by no means easy. Important points are, the physical stigmata of degeneration and developmental defects (such as the size and form of the cranium, the palate and the conformation of the features); the facial appearance dependent upon the development of the muscles of expression; the character of response, interest in games, and especially the power of attention; the mental content taken in conjunction with social environment; and the development of elementary ideas of number, space, or time. In many cases there are aberrations of speech, both receptive and expressive. A look-out must be kept for congenital word-blindness.

Children with deficiency of aural and visual acuity must be excluded, as well as those with other physical conditions, such as adenoids, producing the condition known as aprosexia, and chronic malnutrition, which in some cases seems in its effects to especially single out the nerve centres.

Medical inspectors are told in the schedule issued by the Board of Education to make a special note of such cases, and to make them the subject of a special report to the authority. The Royal Commission on the Feeble-Minded will soon make its report. It is probable that in future provision for defective children, instead of being permissive, may become obligatory. One change likely to be made is the treatment of the lower third of the defectives, who require custodial care.

Morally Defective Children. — This class, although not numerous, makes itself felt out of all proportion to its size. It is most difficult to tackle educationally. Although many are defective, some show considerable intelligence, and can work in the ordinary standards with ease, while remaining, so far as moral control is concerned, imbecile. Their influence in school is very bad, and yet their aggregation in residential institutions presents grave difficulties. A home for morally and mentally defective girls was organised by the School Board for London four years ago, but was given up on account of these difficulties. Recently, at Sandwell Hall, near Birmingham, an institution for mentally and morally defective children has been opened. Legislation concerning these children is included in the present Children's Bill.

Speech Defects and Stammering.—On the continent stammering is more frequent than here. Special classes for these children have long been pretty universal in Germany. Very much can be done in a short time by appropriate training, the correction of abnormalities of the respiratory apparatus, teaching of good breathing habits and exercises calculated to give the child confidence. Recently classes have been instituted in Manchester and other northern cities with excellent results. A wider extension of classes for these neglected conditions is probable.

Epileptics.—These are reckoned to comprise 1 in 2,000 of all children: 85 per cent. of them are unfit for day schools. The only educational provision suitable is the establishment of colonies. Although the Act of 1899 gave powers to local authorities, it imposed conditions which rendered their use impossible. No establishment could consist of more than 4 homes for 15 children each. In 1903 an Amending Act was passed giving the Board power to alter this. But owing largely to the subsequent upheaval in local educational administration nothing adequate has been done. At present the education of no class in the community is so neglected.

Physically Defective Children.—The Act of 1899 gave education authorities power to make provision for physically defective children. The term physical defect has been interpreted in a narrow sense. The Committee had in review only those children who were out of school for organic disease or its effects, and had hitherto been collected and taught by charitable agencies. They did not take into consideration those already in the schools who are unable to profit properly by instruction there. The first cripple school in this country was opened in London in February, 1899, to continue the work done in the Passmore Edwards Settlement; the School Board provided only purely educational expenses, the Settlement providing rooms, transport, etc.

In 1900 the School Board passed a resolution in favour of the establishment of separate schools for the physically defective of normal intelligence, and there are now in London twenty-three invalid schools, with a roll of 1800 children. Each school is served by one or more ambulances in which the children are brought to and from school, and a nurse attends to their conveyance and care in school. Children with discharging sinuses should be rigorously excluded. In these schools the Board of Education requires 18 square feet per child. Mr. Elmslie made an analysis of 1000 of these children last year; their defects comprised tuberculous bone and joint lesions, 50 per cent.: deformities arising from rickets, septic conditions or congenital defect, 14 per cent.; infantile paralysis, 11·5 per cent.; spastic paralysis, 6·4 per cent.; heart disease, 12·4 per cent.; various diseases (chorea, etc.), 5·4 per cent.; delicate children without present disease, 5 per cent. Classes for crippled children are a most valuable part of the educational system; without the special arrangements made, no education would be possible for them, and they would become dependent upon the community for their support in after-life.

The small class of children both physically and mentally defective requires treatment in homes; at present nothing is done.

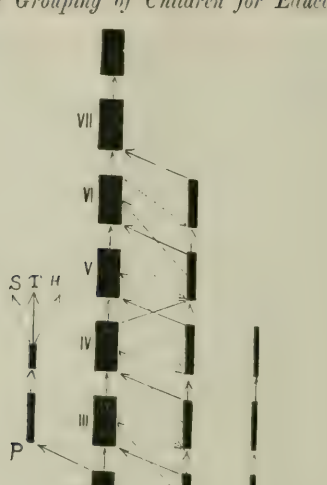
The Need of Auxiliary Classes.—Although the advisability of separating feeble-minded children is accepted, it is not yet recognised that there is a large number of children (at least 10 per cent.) who are not mentally defective, yet make little progress in ordinary schools, and to whose needs ordinary educational methods are not adapted, where, indeed, they are not harmful. These comprise children with serious visual defect, those partially deaf, debilitated and nervous children (and especially children whose memory is of the motor type) who make no progress with ordinary methods, although quite intelligent.

Nothing is done for these children except to form for them a Standard 0, which, attached to another class, gets the fitful attention of a teacher who struggles in the vain attempt to teach them according to routine methods. These children would repay to a greater extent than mentally defectives for special provision.

Some find their way to special classes and there make good progress. The partially deaf children in the defective schools progress more quickly than do the defectives as a whole, indicating that their defect is in the majority of cases due to deafness and not to naturally deficient mental powers. In time we shall probably see intermediate classes established in which manual instruction will be the basis of training. At present, in schools where manual training (woodwork, cookery and laundry work) is provided, only children who reach the Fifth Standard attend. As these children never reach this standard they are therefore debarred altogether from the only mode of training to which they are likely to respond.

The best classification on these lines which has hitherto been carried out is that followed in Mannheim and illustrated in the accompanying diagram.

This system seems as near perfection as possible; the diagnosis of mental defect is rendered easier; the borderland cases, which are so difficult or impossible to define and give the medical examiner much trouble in this country, are passed without hesitation into the auxiliary class. At the end of a year no doubt can be entertained. That it is much more scientific than ours is shown by the fact that, while constant interchange goes on between the ordinary and auxiliary classes, there is no passing back again from the defective classes as in England. Some of these children with aural or visual defect are really physically defective, but hitherto there has been no attempt to broaden the definition to include them. Last year, however, the definition was extended by the recognition by the Board of Education of an open-air school in London for debilitated children as a physically defective school.



The Mannheim Special Class System.—(The Annual Report of the Medical Officer of the School Board for London, 1904.)

A. The Ordinary Standards.

B. The Forderklassen System (called Intermediate Classes in England).

C. The Special Classes for Mental Defectives.

I. Imbecile Institutions.

P. Preparatory Classes for Secondary, Higher, and Technical Schools.

The arrows represent the course of the children: the continuous lines regular promotions: the dotted lines those sent down for simpler education: the interrupted lines those promoted during the school year.

Column A shows the standards of an elementary school; a child unable at the end of the year to pass up with his fellows passes into an auxiliary class, with modified curriculum whose numbers are limited to thirty-five. Here he obtains more individual attention. Out of this he passes back into the ordinary school or on to the next auxiliary class or descends to column C, which represents the special school for defectives.

Open-Air School.—This school was formed after the Charlottenburg pattern. It was arranged in an open space in the woods. The buildings consisted merely of wooden shelters from the rain, and latrines. The children spent all day at the school, were fed and kept entirely in the open air, during the summer and autumn months. They included those suffering from debility, anæmia, adenoids, enlarged glands, and so on, of whom there are such a number in the schools. The results were surprisingly good. The average increase in body weight was about 7·5 per cent. in six weeks, and some put on so much as 15 to 16 per cent. The hæmoglobin percentage increased, and the children improved in spirits and in intellect. Three such schools have been opened in London this June.

Chronic Parasitic Diseases.—There remains but to mention the children who spend long periods, often the whole of their elementary school life, without any education on account of these conditions. Until the Administrative Provisions Act of last year the Guardians of the Poor alone had power to provide schools for such conditions as ophthalmia or ringworm.

In London ringworm accounts for a large amount of non-attendance. A start in the way of day schools was made in June, 1906, by the opening of a school for favus in Whitechapel, attended by about 100 children. Treatment is now permissible, and an X-ray apparatus has been installed. The introduction of this treatment has altered the outlook so far as ringworm is concerned. It would probably be far less costly for education authorities to undertake this treatment (as is done in Croydon), fitting the children in a short space of time for attendance at an ordinary school, than to maintain special schools for ringworm.

In conclusion it should be pointed out that the country and the city in which we are meeting have been in no wise behindhand in attention to these matters. Wales has been said to fall far short of what is required in sanitary matters, but no one has accused the Principality of being backward in enthusiasm for education. And behold! we are now assured that what she has chosen is the better part of public health.

[*For Discussion on this Paper see page 183.*]

THE HELP OF THE TEACHER IN THE MEDICAL INSPECTION OF SCHOOL CHILDREN.

By W. LLOYD EDWARDS, D.P.H.,

School Medical Officer, Barry.

(MEMBER.)

AT the beginning of this year the medical inspection of school children became one of the compulsory duties of all local Education Authorities. Hitherto, whilst a large number of Education Authorities had provided for medical inspection of schools, the sanitary condition of the building, etc., the regular systematic examination of each scholar had not been arranged to any great extent.

In this, we were far behind most other civilized countries. In Brussels a system of medical inspection was instituted about twenty-five years ago, and in one of the special reports on educational subjects, a full account is given of the procedure, the children even being given an iron tonic mixture from a large bottle.

In Japan they have organised the medical examination very thoroughly, whilst in Germany a recent pamphlet published by our Board of Education states that they "have systematised the medical inspection of the primary schools beyond any other country."

In Hungary the school medical inspection has been taken very seriously, and no medical man is allowed to commence duties until he has attended a three-and-a-half months' course of special instruction in school medical inspection. Many of the larger cities of America have also organised the medical inspection of schools on a very complete scale.

Whilst, therefore, we have the benefit and experience of the work in other countries, those medical men who have now taken on those duties in consequence of the Education Act, 1907, have to work out many problems and details with but little past experience to guide them. Perhaps I ought to except the splendid record of work done for the London County Council by the Medical Officers of Education as shown in the five annual reports by Dr. Kerr.

One of the main problems has been how much can or ought we to expect the teachers to help in the work. During the discussions prior to

the passing of the Act there were some who strongly opposed any Act making the medical inspection of school children compulsory, until a new generation of teachers had come into the schools who had been thoroughly trained in hygiene. Doubtless such a training is highly important, and one is gratified at hearing that the Board of Education intend making hygiene one of the subjects for training college instruction: but it must be remembered that now, for many years past, teachers have had some knowledge of hygiene. Recognising its importance they attended South Kensington Science Courses in Physiology and Hygiene, and, indeed, especially among the girls, by means of Readers and in Domestic Economy teaching, some amount of hygiene has been taught in the schools. I think all this proves that the teachers are as a rule competent to give valuable assistance in the matter of school inspection. They are fully aware of the immense importance of the physical condition of the child and its bearing on its progress in school, and the teaching profession has everywhere welcomed medical inspection, as tending to aid materially in their work. In Germany "many teachers from the first heartily greeted the school doctor as a co-worker, whose functions well supplemented and supported their own, and suspecting no necessity for jealousy and friction found none. Others regarded the school doctor not as a colleague, but as a rival, and viewed his coming with distrust."

With regard to this, the same pamphlet, "School Doctors in Germany," from which I have just quoted, states that Dr. Schubert, a well-known authority on this subject, is of opinion that the strongest opposition comes from those teachers who have no school doctor in the locality, and are only expressing the fear of the unknown.

Dr. Leslie Mackenzie, Medical Member of the Local Government Board of Scotland, said in a paper read before the last International Congress of School Hygiene, "that he found that the teachers have taken to medical inspection with enthusiasm. They were in Scotland the chief promoters of the movement. They have in many places welcomed expositions of what the proposed inspection implies. In one or two places where a medical officer of schools has been appointed, they have offered him the most cordial assistance. Recently the school teachers of Glasgow collected a vast number of observations on the height, weight, and physical conditions of the children. In Edinburgh, the medical officer of schools has, with the cordial co-operation of the teachers, carried through a preliminary enquiry into the acuteness of vision of the school children." "Everywhere the report is that the teachers find the work full of interest." The teacher is able to provide essential details as to age,

occupation of parents, size of house, regularity of attendance, hours of rest and work. He can also record height and weight. It is easy to see that the teacher is at every stage of the child's school life an indispensable and reliable coadjutor in medical inspection. Above all, he is in constant touch with the parent.

We may therefore be well assured that the teachers as a whole will gladly welcome and co-operate with the medical officer. But if we can count on their ready and willing help, one must consider how much additional work it is fair to place upon the teacher. Only those who have spent much time in the schools, can realise the multitudinous duties which devolve upon the head teacher. Besides the usual school work, and examination of classes, there are numerous interviews with parents, attendance officers, etc. We must therefore be particularly careful not to give them too much to do, though a good deal of their help is indispensable. Though I have only recently commenced my duties as a school medical officer, I can at least claim a thorough knowledge of the schools, teachers, and scholars, having for many long years been intimately associated with the growth of the educational system of Barry, as a member and also as Chairman of the School Board. It may therefore be of interest to give my experience as to the help the teachers have given me in my work.

First of all it is only right to state that, compared with many places, the teachers are working under favourable conditions. According to a Board of Education return the classes are smaller in Barry than in almost any other district, there being 26·6 certificated teachers to every 1,000 children, which, with the exception of Hornsey, is not exceeded by any other place in England and Wales.

It would not, therefore, be fair to expect so much from the teachers of other districts, where possibly they may have very large classes and overcrowded buildings. In starting the system of medical inspection I first of all met the head teachers in conference, and explained to them the requirements of the Board of Education. These were of a minimum amount, and the schedule of the Board has been adopted in its entirety with one or two modifications.

I explained that as the examination of each child would practically be triennial (at entrance, at the ages of seven and ten years and at leaving), such details as height and weight would be of scarcely any value if taken only once in three years. In Germany, the height and weight are taken every six months, and an annual weighing and measuring of each child was necessary if any useful information was to be derived as to physical development. But such annual data could not be obtained by the school

medical officer unless each teacher took them for his own class. The opinion of the head teachers was in favour of doing this work annually, so that even in the first year I hope to have every child in the Barry Schools both weighed and measured. Some of the teachers had already been taking the height of the boys in connection with the annual athletic sports, which I am glad to say have been very successfully and enthusiastically worked by the teachers. At my first visit to one of the boys' schools I found that the older boys, while at the educational handwork centre, had made a most elaborate measuring standard, all complete with platform and scale in inches and centimetres properly marked. This indeed was co-operation.

The procedure adopted is as follows:—Two cards are given for each child in a class, the duplicate one being for the central office. On this the class teacher, or, in the case of older children, the child himself, writes:—Name and address; name of school; date of birth; and also height and weight in centimetres and kilograms. Once a year also the class teacher will enter on this card the possible and actual attendances of the child. This will be a comparatively easy matter, as these attendances have already to be looked up on the register for the attendance prizes which are awarded annually. Indeed, these cards will in the future do away with the necessity of hunting up a lot of old registers in the case of children who have made an unbroken attendance for seven years, and so obtained a special prize, and these are by no means uncommon. I regard the actual attendance of the child as being a very important record. Speaking broadly, there are only two main factors in bad attendance, bad home conditions, careless parents, etc.; so that the actual attendances will in after years be of great use to the school medical officer in estimating the physical status of the child. At Barry, before the actual examination is held a circular is sent out to all the parents explaining the new Act as regards medical inspection, and inviting them to return a card with a schedule of diseases, filling in which the child has had, and whether before or after admission to school. These cards, on their return, are stored for the medical officer to copy on to the proper column on the medical inspection card. I am glad to say that the teachers have succeeded in nearly every case in having the card back from the parents. One headmaster told me on my visit of inspection to his school that every card had been returned. The information gained will be valuable. Already from a glance at these cards I am surprised at the number of children who are reported to have had measles and whooping cough before their entrance into school. However, I have not had time

to obtain any actual statistics on this point, but I can see that such information will be of importance in regard to the question as to whether children should enter school before five or not.

Of course, the medical inspection finds every child, warned beforehand, ready for the doctor with "shining morning face," so that, in recording the state of the body as regards cleanliness, clothing, etc., it is the teacher who can give a really accurate estimate. It is the same with regard to the mental condition of the child. Whilst the personal observation of the school doctor soon becomes a fairly accurate one, it is always well to know the teacher's opinion, as he has had long and continuous chances of estimating; and, besides, is trained for that work.

At Barry each school has a vision-testing register, which hitherto has been filled up by the teachers. After this year the school medical officer will be able to do the vision-testing himself: but at present, whilst he tests the vision of all children medically examined this year (except, of course, the young infants), it would be impossible to test every child. I find, however, that the teachers who have been doing this for some years rather like the work, and in cases of defect draw my attention to the errors. Where any eye defects are discovered a coloured card is sent to the parent with advice as to the proper procedure.

There are also similar cards of various colours for all the more usual defects, such as adenoids, bad teeth, deafness, etc.

At first sight all this seems a lot of work to the teacher, but after the first year the work will be very slight, as each child will be examined only about once in three years. The trouble is well worth taking if the teacher can manage it. Just as in the scheme of school work the subjects are now all correlated, we shall find the inter-dependence of the school doctor with the school teacher; and one speedy result of medical inspection ought to be the throwing more light on the dark places in our educational system. The huge classes we find in some schools are perfectly absurd. With them there can be no individual attention, and, what is so important for the teacher, there can be but little knowledge of each child's nature, and allowances for each little individual's idiosyncracies.

Then again the overcrowding in our primary schools is very great. The space of ten square feet per child prescribed by the building rules of the Board of Education is itself far too small, but even this is sometimes reduced in practice. I have seen new and beautiful buildings with class-rooms empty and an adjoining one fearfully overcrowded with children—all owing to the fact that one teacher could not be in the two class-rooms at the same time.

Let us hope that the advent of the school medical officer will at least tend to make the burden of the teacher's life lighter. I have briefly sketched in this short paper what could be considered the amount of help which ought to be expected, and as all are working for a common object I do not think that school medical officers, provided they have tact and due consideration for the teachers, will ever find lacking that hearty zeal and co-operation on the part of the teacher which alone can make this work of lasting benefit to the children.

[*This Discussion applies also to the Paper by* Dr. C. J. Thomas, *page 767.*]

Dr. H. Meredith Richards (Croydon) emphasized the readiness with which teachers would co-operate in the work of the medical officer, and the importance of reducing clerical work to the smallest possible dimensions. The school nurse, too, could lighten the work.

In Dr. Thomas's paper he was most interested in the proposed auxiliary classes which met a very real want in our educational system. In his own district they had initiated such a class in connection with a small group of schools. To this class, which would be limited to twelve, children, boys and girls, would be admitted after examination by the inspector and medical officer. It was intended to reserve the class for children who would eventually be transferred to the ordinary school, or at any rate be educated by the special methods of the class into normal citizens. The mentally defective child was best provided for in residential schools and subsequent colonies.

Miss C. Cochrane (St. Neots) said that dull but not mentally deficient children should be allowed to leave school at the same age as others in the school. Prolonged attendance did not render them more fit to follow their vocation in after life, especially if this was agricultural.

Elder girls and infants should be examined by medical women.

Attendance of children who were between five and six years should be optional.

Miss Morris (West Riding C.C.) urged the willingness of many teachers to co-operate in anything which was for the welfare of the child. Home conditions were not ideal in many cases, and the prospect of having pressure brought to bear on parents to have the health of children attended to would generally be welcomed.

In districts where the system of half-timers still obtained, it was often found to make too great demands on the children, and especially where conditions of ventilation, etc., were defective, it becomes a matter of question whether beneficial, either physically or mentally.

Mr. T. W. Berry (Rhondda) advocated the formation of auxiliary classes, but the whole question was one of finance, as was also the question of increased floor space. He deprecated on social, mental, physical and economic grounds the half-time system of schooling. With regard to mentally defective and slow children, educational handicraft was the remedy if followed by the formation of mentally defective colonies and agricultural training. Teachers were keenly in sympathy with the medical inspection of schools, but they strongly opposed the idea of this constantly increasing clerical work. Teachers were trained to teach, and to utilise them in side issues was economically and educationally unsound.

Dr. Williams (Flintshire C.C.) questioned how far it was advisable for teachers to do the clerical work in connection with the medical inspection of children. Their duty was to teach, and this was necessary, and their time for teaching ought not to be curtailed. Again, what was the best method specially for the rural district as to medical inspection, whether the local medical men would not be able to do the work best, as they knew the home life of the parents and children, and could see as to the carrying out of treatment.

Dr. J. F. McFadyen (Govan) said the teachers gave him very hearty co-operation in the discharge of his work as medical inspector.

Interviews with parents were requested in the cases where defects were discovered. The response was very satisfactory.

Mentally and physically defective children were taught in separate schools. They were taught according to their capacity. Their lives were made as bright and comfortable as possible. They were taken to and from their homes to the school in very comfortable vans.

Mr. A. W. Swash (Cardiff) said that he should be exceedingly sorry if there was any general impression among the audience that teachers were opposed to medical inspection of school children. On the contrary, the matter had been discussed very carefully in Cardiff, and the whole desire amongst the profession was to assist in so useful and praiseworthy an object. But the teacher was fundamentally in existence to impart knowledge, and he could only spare a certain amount of time without interfering with the actual teaching work. So far as opportunity allowed they would second the efforts of the medical officer to the very utmost of their ability. No subject was so important as ventilation, yet he felt the Board of Education did not insist on a sufficient amount of fresh air being supplied even in the newer schools. Teachers pressed for more ventilators, the Board of Education inspector was sympathetic, but Education Committees and Managers evaded their responsibilities.

Dr. J. R. Kaye, Miss A. Ravenhill, Dr. C. J. Thomas, and Dr. Lloyd Edwards also took part in the discussion.

THE LIMIT OF SCHOOL CHILDREN'S CAPACITY FOR ATTENTION.

By PROF. WILLIAM PHILLIPS, M.A.,
University College, Cardiff.

Experimental Inquiries into the Question.

THE effect of mental work on the various parts of the body, especially the muscles, and that of bodily labour on mental functions, have in a general way been long known, and various methods of measuring these effects have been proposed. Within the last twenty years similar tests have been applied to school children. Two of the best known involve the use of various forms of Mosso's ergograph or fatigue-recorder, and Griesbach's asthesiometer. Dr. Ferdinand Kemsies was the first to apply the former instrument in investigations on fatigue in children, in some of the Berlin schools. Professor Griesbach used the latter to test the sensitiveness of children's skin, in the schools of Mülhausen, Alsace. Since then similar inquiries have been carried on in various parts of the world, by many other investigators. It has also been attempted to test the change in attention by observing the rate of the deterioration in mental work done at different times of the day and on different days of the week. These tests generally consist of homogeneous tasks, such as adding or multiplying, writing passages from dictation or by means of transcription, etc. A Russian teacher, Sikorski, is believed to have first made inquiries of this kind. Those made in 1897 in a Würzburg school, by Dr. Johann Friedrich, seem to me among the most valuable of this class. Reaction-time experiments are more limited in their scope.

The generally Disappointing Character of the Results.

The value to the practical teacher of these numerous inquiries is small. The reasons for this are fairly clear:—

1. The results obtained by the same investigator from the same type of experiment are often difficult to reconcile.

2. The difficulty of interpreting some of the results is practically

insuperable. A good illustration of this is supplied by Griesbach's æsthesiometric tests. It may be explained for the benefit of lay readers that when points of a pair of dividers (say) are placed lightly on the skin they are not recognised as two unless they are a certain distance apart, and this differs for different parts of the body. The normal (critical) distance for the tip of the tongue is 1 millimetre (about $\frac{1}{25}$ in.), for the palm of the hand 11 millimetres, and for the breastbone 44 millimetres (about $1\frac{3}{4}$ in.). After the performance of any mental work, however, the points must be removed further apart if they are to be separately recognised. Professor Griesbach applied this test to many school-boys at different hours of the day. Appended are the results of the observations made on a boy, 11 years of age.

The distances at which the two points of the æsthesiometer were separately recognised.

	7 a.m.	11 a.m.		2 p.m.	4 p.m.
A. Forehead ..	3·5 mm.	9·5 mm.	3 hours' interval.	4·5 mm.	11 mm.
B. Cheekbone ..	4 mm.	13 mm.		6 mm.	14 mm.
C. Tip of 1st Finger	1·5 mm.	2 mm.		1·5 mm.	2 mm.

Taken separately, these results are curious. A seems to indicate that the boy was $2\frac{5}{7}$ times as tired at 11 a.m. as at 7; B suggests that the tiredness is $3\frac{1}{4}$ times as great as at 7; while C only shews that it is $1\frac{1}{3}$ times as great. Which are we to accept? Are we to accept one? At 2 p.m. the same boy seems (a) $1\frac{2}{7}$ times, (b) $1\frac{1}{2}$ times, and (c) equally tired as at 7 a.m.! Other results are just as hard to interpret.

3. The results obtained by applying different tests to the same individual are extremely contradictory. The investigations conducted by Ellis & Shipe, and reported in the *American Journal of Psychology* for 1903 were specially directed to this point.

(*a*) The results got from certain reaction-time experiments were compared with the ergographic records made either immediately before or after: they were very contradictory.

(*b*) A comparison was made between the results got from a set of four methods, (1) reaction-time tests; (2) the accuracy shewn in adding columns of figures; (3) the accuracy shown in writing down the cubes of numbers; and (4) the number of nonsense-syllables committed to memory. A fixed time was given for 2, 3, and 4. Here again contradiction prevailed.

(*c*) These four tests, slightly altered, were repeated a year later

on other subjects, but they were equally disappointing. In the case of no one individual did all the tests agree.

(*d*) A similar set of experiments was tried on school children of average ability, between 11 and 15 years of age. (Tests a, b, and c were applied to adult students.) They were tested on three days at 9 a.m. and 2.45 p.m., the opening and closing hours of the school. In only one case did the results show the same thing: then they indicated greater power at 2.45 p.m. than at 9 a.m.!

4. None of the mental tests (such as adding numbers, learning nonsense-syllables, etc.), were given in conditions similar to those prevailing in an ordinary lesson. It is, therefore, hard to say whether the results were affected by the uniform nature of the task. It may be that any improvement shewn is due to a special effort, or a deterioration to the monotonous character of the work.

5. Other experiments, like the reaction-time inquiries, are of too restricted a kind to furnish means of comparison with the effects of school-work. They are of course very helpful to the psycho-physicist.

In spite of these and similar objections, the various experiments have corrected our views on some matters, and clarified them on others.

SOME USEFUL RESULTS.

1. The various tests seem to agree on one point, that during an ordinary school-session children can maintain a more even degree of attention, if intervals of rest are included. From two of ten minutes each, more advantage is gained than from one of twenty minutes.

2. The tests seem to agree too in showing that a child's attention wanes more rapidly in the afternoon than in the morning. Therefore those teachers who have been accustomed to place the less taxing subjects of instruction in the afternoon seem justified.

3. The various branches of mathematics seem, *ceteris paribus*, to make a greater demand on the attention than most other subjects. This result has long ago been anticipated by those teachers who place mathematics early in the morning session.

4. Gymnastics is not of necessity a mentally recuperative subject. Some tests proved that children were often tired after a lesson in it.

5. In connection with the extent of the fatigue caused by gymnastics, it soon became obvious that the results did not depend on the nature of the exercise alone, but also on the teacher. If the latter is a strict disciplinarian, the fatigue may be of a pronounced character.

6. It is clear that attention depends on numerous factors, such as

the age, health, and nutrition of the child, the temperature and ventilation of the class room, etc. But above all it depends on the child's training and education.

Attention and its General Conditions.

Attention may be defined in a simple way as a conscious process in which one idea or group of ideas stands out with greater clearness than any others. It is succeeded, or accompanied, by wide-spread motor-phenomena. Pillsbury in his recent book on Attention (1908) summarises them as follows: (*a*) The muscles of the sense organs contract to give the greatest possible effect to the stimulus. (*b*) The voluntary muscles of limbs and trunk undergo contractions that have previously been found useful under stimulations of the same kind. (*c*) There is a diffuse contraction of many voluntary muscles without reference to the nature of the stimulus. (*d*) The respiratory and circulatory processes are profoundly affected.

Account must furthermore be taken of the many nervous processes involved, especially those of the cortical centres.

The same writer reflects the best and most recent thought on the conditions of attention when he says that they are to be found "in the present environment (objective conditions) and in the past experience of the individual (subjective conditions). The main objective conditions are the intensity, extent and duration of the stimulus. The subjective conditions are to be found in the idea in mind at the time, in the mood of the moment, the education, previous social environment, and heredity of the individual." With every year added to the child's age, the objective conditions become more important, and the stimulus plays a smaller part.

Is it any wonder that the experiments referred to have been largely ineffective in giving definite guidance to the teacher concerning a mental process, governed by so many conditions, physiological and mental, and accompanied by so many closely connected motor phenomena?

These experiments have however done their share in bringing about the medical inspection of schools by calling attention to the fact that a child's power of attention depends to a large extent on his physical condition, and in particular on the state of his sense-organs. We can therefore hope that the teacher will in future be furnished with such a knowledge of children's defects as will enable him to make the best arrangements for seating his pupils in the class-room so that they may see and hear to the best advantage. I assume that any relevant information of this kind will not be locked up in the medical officer's desk or in bulky reports. The

inspection will also do a good deal towards the alleviation, cure, and prevention of such defects.

The task of determining the capacity of a child for attention will still rest mainly with the teacher, and if it is to be satisfactorily performed, he must give his pupils individual attention. He can easily make himself acquainted with the common symptoms of fatigue, and if the following matters are also kept in mind, they may prove helpful.

How to maintain Children's Attention at its Full Capacity.

The teacher should have regard to the following considerations:—

1. The age of the child.

2. Its physical condition, and especially the state of its eyes.

3. The importance of properly lighting, warming and ventilating the class-room, securing a hygienically-constructed desk, selecting books with the right kind of paper and sufficiently large and properly-spaced type, and placing the blackboard, maps and diagrams in the right light and at the correct distance from the class.

4. In the case of young children especially, the posture should be changed once or twice during certain lessons.

5. The necessity for periods of rest and play in both morning and afternoon sessions. Not much attention, from the point of view of fatigue, need be paid to the demand for lighter work on Fridays and Saturdays.

6. There must be rotation of lessons, so as to secure alternation between heavier and lighter occupations, or between occupations that make different demands on the various organs, such as the eye and the hand.

The importance of placing mathematical studies early in the day has been referred to. The early stages of learning Latin, Greek, French and German are also exacting, and lessons in these, and in all subjects involving extensive memory work, should not be placed at the close of a session.

7. The afternoon lessons should be of a somewhat non-exacting character, with the possible exception of the first.

8. The knowledge of the subject taught which is already possessed by the child must be taken into account. Increased knowledge ought to be accompanied by increased capacity for attending to similar material.

9. As suggested in the preceding paragraph, the maintaining of attention at the highest point is not mainly a physical or physiological question, but a mental one. Hence arises the necessity for varying the teaching and learning procedure. Expositions, questions, illustrations,

problem work, and private study should be employed as the occasion demands. One of the chief reasons, however, for much of the inattention in our schools arises out of the fact that too little work is demanded from the pupils, not too much. They are told too much, and are given too few opportunities for overcoming difficulties unaided. Their full activity is often never fully aroused. Attention has not only to be aroused and maintained, but also developed.

Length of the Lesson Periods.

Shaw, in his book on School Hygiene (1902), suggests the following periods :—

For children between	6	and	7,	a period not	exceeding	10	minutes.
„ „	7	„	9,	„	„	15	„
„ „	9	„	11,	„	„	20	„
„ „	11	„	12,	„	„	25	„
„ „	12	„	13,	„	„	25 or 30	„
„ „	13	„	14,	„	„	30	„
„ „	14	„	15,	„	„	40	„
For those above	15,			„	„	45	„

Several other writers suggest similar periods. My experience leads to the conclusion that the shorter periods are not long enough for effective work in classes containing from 35 to 40 pupils. It must be remembered that in very rare cases is the undivided attention of the pupil demanded for the whole lesson-period. Answers to oral questions will be succeeded by an exposition or description, the exact demonstration of a geometrical problem by the making of a model or the construction of a figure, and so on. Considerable time is also sometimes rightly spent during the course of a lesson in drawing a map or diagram on the blackboard, in reading an illustrative poem or prose extract, or in the examination of a botanical specimen. In this way a rhythm of close and relaxed attention is secured. Each of the shorter periods could therefore be safely extended by at least five minutes for the usual kind of class lessons.

Conclusion.

A child's capacity for attention depends upon many factors, of which the following are very important: (*a*) the hygienic character of the building he is taught in, and the length of the lesson-periods, school sessions and terms: (*b*) the teacher's knowledge, teaching skill, and

his personal and professional ideals; (c) the child's stock at birth of physical and mental powers, and his subsequent environment, training and education.

Dr. C. J. Thomas (London County Council) said he considered that one reason for the apparently inadequate results from tests of fatigue or power of attention in children was to be found in the neglect to record the conditions by which the children under observation were surrounded. The outcome of certain experiments he conducted in London schools pointed to the strong influence of ventilation on both these points, but they were not sufficiently extended to justify any definite conclusions.

Miss Alice Ravenhill (London) spoke on the results of investigations into fatigue in school children in Japan, which agreed in showing that well conducted physical exercises prove more fatiguing than any other subject in elementary or high schools; she also referred to the arrangement of the time table, which was the result in Copenhagen of observations as to the time of day when fatigue seemed most strongly exhibited in connection with physical exercises.

Principal Griffiths also took part in the discussion.

THE USE OF SPRAY BATHS IN ELEMENTARY SCHOOLS.

By FREDERICK ROSE, M.D., Ph.D.Berlin.

Assistant Educational Adviser to the London County Council.

PERSONAL cleanliness is desirable both from a physical and moral point of view. Founders of old religions, like those of the Indians, Assyrians, Jews, Egyptians, and others, insisted upon frequent ablutions, and made them religious observances. They were not only the thinkers, but also the hygienists of their peoples. But cleanliness as a national virtue still remains to be taught. This must take place on a comprehensive and systematic scale. In other words it must form an essential part of the education of the young.

It is only during the past 30 years that the movement of teaching cleanliness in elementary schools by means of spray baths has been in evidence, principally in Germany. Attention was first given to abundance of light and fresh air. Now it is time that the claims of the skin were attended to.

The usual objections will of course be raised. It will be said that cleanliness is outside the province of education. This can be easily refuted to-day, when the educative effect of personal cleanliness can no longer be disputed. We must lay stress upon the fact that the best place for teaching is at school, and the best age, the school age. Cleanliness was not included in the Code of 1870, but that also applies to many other subjects now taught and to which nobody objects. Let us remember that bodily cleanliness is the result of custom or instruction or both combined. No child is born with the sense of cleanliness and no child develops this sense spontaneously. People accustomed to cleanliness, or trained to it, strive to remain clean. But they are in the minority, and the unfortunate majority cling tenaciously throughout their lives to their uncleanly habits.

As the majority of parents were unable to provide the instruction

which all units of a community must possess, the State made elementary education compulsory, and undertook its management. In addition to the ordinary subjects of instruction contained in the original code, it added later, for similar reasons, physical exercises, manual training, domestic economy, and other subjects. One of the things still wanting is thorough and systematic instruction in the care of the skin, the great regulator of the body. Too few people recognise that the skin is not only a protective cover for the body, but is also in its special functions just as important as the heart, lungs, and kidneys, and that the care of the skin is most important during the years of growth.

Objections raised on the score of time can be easily answered if the proper kind of bath is decided upon. There is not the slightest doubt that spray baths are the most suitable kind for the object aimed at. This is the provision of at least one or two cleansing baths per week for all children in elementary schools. The best and cheapest way to cleanse and stimulate the bodies of school children is to give them warm spray baths, soap them down, and finish up by a moderately cold douche. The advantages of this system are many. The cleansing process is more thorough, the dirty water is continually rinsed away, fresh water is constantly supplied, the danger of infection is reduced to a minimum and finally the physiological action of the water is much more effective.

It is out of the question to use slipper baths for large numbers of children. They are too slow, cost too much in installation and water, and may possibly convey infection. The bathing takes place in what is practically stagnant water of a constant temperature, and the invigorating effect is therefore entirely missing. For cleansing purposes they are by no means as hygienic as shower baths.

In many parts of Scandinavia hot steam baths are given, followed up by cold douches. This does not seem practicable at present for large numbers of children, but experiments might be made in this direction in connection with the spray bath system. The hot vapour bath, of course, goes a step farther than the mere spray bath, as it opens up the pores of the skin more thoroughly. For the present, however, spray baths seem to be the most suitable form of school baths, and have been adopted for this purpose by Germany, Austria, France, Switzerland, Belgium, Holland, and Scandinavia. Some of these countries make use of spray baths in their armies, factories, and public baths.

A great advantage of the spray bath is that it meets the objection raised on the score of time. A school with an installation of about fifty

sprays can wash a whole class thoroughly in twenty-five minutes. If the children attend a shower bath centre more time will be required according to the distance. If a school possesses only an installation of ten douches a great deal can be done with even this small number. Any dislocation of the instruction in the latter case can be avoided by carrying out the bathing during the writing, drawing, or drill lessons, where the thread of instruction is not affected by a short absence.

Germany has initiated this great reform in school hygiene. During the last thirty years a regular development in school bathing has been gone through, and now all new schools in Germany are provided with spray baths, and a great many old ones are being fitted with them. At Nuremberg 21 out of 70 schools have spray baths; at Munich 35 out of 53; at Mannheim all schools with the exception of three old ones; at Frankfort 26 out of 30. At first installations were to be found in dark basements, badly lighted and ventilated, and not very accessible. Large zinc tubs and very primitive douching arrangements were provided. In the second stage of the development troughs let in the floor were substituted for the zinc tubs, and ventilation, light, and general equipment were improved. At the present time the installations are on the ground floor, or only a few feet below; they are easily accessible, well lighted and ventilated, provided with tiled troughs, and marble or tiled walls. The douching apparatus is of the most modern and most perfect description.

From 60 to 90 per cent. of the children bathe, and very little difficulty has been experienced on the part of parents. In many cases the authorities issue circulars drawing attention to the value to the children of using the spray baths.

In Austria, Switzerland, Belgium, Norway and Sweden good progress has been made, though not to the same extent as in Germany. At Basle, for instance, there are only two schools not provided with spray baths.

In France the progress of the movement has been less marked. Holland, Italy, and Denmark have begun well. A large number of schools in Amsterdam possess good spray baths. They are inferior in quality to the German installations, but very efficiently and sensibly worked. Amsterdam possesses also a special feature in the shape of a shower bath centre, which bathes the children coming from about fifteen surrounding schools. It cost £1,500 to build and equip, and the maintenance expenses per annum are about £300.

Let us turn to England and examine what has been done to teach bodily cleanliness on a broad comprehensive scale. The sole spray bath

installation for the 780,000 London school children is one of four douches at the Pulteney School, Shaftesbury Avenue, but small as it is it manages to provide some 6,000 or 7,000 baths per annum.

Edinburgh has some swimming baths but no spray baths. Govan, Bristol, Liverpool, Birmingham, Newcastle-on-Tyne, Manchester and Nottingham have made some provision for swimming, but none for school spray baths for cleansing purposes. The only town which has followed the German example and introduced spray baths for cleansing purposes in schools is Bradford. This is due to the efforts of Miss Macmillan, who has long advocated their introduction. Norwich is about to follow Bradford's example and install shower baths in one of the elementary schools.

It is very dispiriting to find this condition of things in England. It almost seems as if the sting of the old reproach concerning the cleanliness of the foreigner had been turned against ourselves.

There are of course difficulties in the way of the introduction of shower baths in the English schools. Take London, for example. Few of the schools are so constructed as to permit of the installation of spray baths in their basements. It would, therefore, be necessary to build separate buildings to serve as spray bath centres. On account of the heavy expenditure for sites, parts of the playgrounds might have to be utilised. A suitable spray bath centre to be used by ten schools could scarcely be erected in London under £2,500. About 100 such centres would be necessary, and we should, therefore, have an initial expenditure of at least £250,000. The annual maintenance expenditure would run to something like £50,000 to £60,000. For these sums between fifteen and twenty million baths would be given annually. The least we can do, however, is to insist upon all new schools being provided with spray baths, and to set to work gradually to provide spray bath centres for the older schools. Government aid might be solicited as part of the scheme of medical inspection and treatment of school children. Little is to be expected from private sources, as English millionaires are deaf to appeals on behalf of elementary schools.

It is scarcely recognised that in spite of what Germany has done in school spray baths, and Germany and England in swimming baths, the twentieth century is still far behind antiquity. At the time when Constantine removed his residence to Byzantium, Rome possessed no less than 860 public baths, with a daily consumption of some two millions of gallons of water.

It is necessary to mention a very important matter here, that is, the

manner in which in England swimming baths have, unfortunately, come to be regarded not only as swimming baths, but also as cleansing baths. This is a very great mistake, as their true sphere is to provide physical exercise of a complete description, combined with a gentle invigoration of the skin. For cleansing purposes the spray bath with hot and cold water and soap should be used. Town swimming baths in Germany are in most cases carried on in a much more sanitary manner than in England. No persons are allowed to enter the swimming bath without having thoroughly douched and washed themselves beforehand. The water is renewed as often as possible, in many cases every day throughout the whole year. In England, I am afraid, there are very few swimming baths where compulsory previous douching is required, or where douches are provided. On the contrary, a great deal of perverse ingenuity has been expended in ridding the water of the scum and sediment which naturally accumulates when dirty persons use the swimming pool. I know of one bath in London which is fitted with a steam pipe, perforated with holes placed about an inch above the surface of the water at one end of the bath. The object of this pipe is at stated times to blow off the scum to the opposite end of the bath for purposes of removal. At another bath, a long wooden pole is provided and is dragged across the surface of the water to collect the scum. At an Edinburgh school a few years ago, the water was only renewed once every three weeks, although 400 children per week used the swimming pool. The sediment which naturally collected at the bottom was carefully coaxed by means of a long-handled broom towards the lower part of the bath, and then drawn off by an ingenious suction apparatus, in order to prevent any appreciable loss of water. A little common sense in the shape of the installation of a few douches, and making douching compulsory before entering the swimming pool, would have been much simpler than this enterprising application of perverse ingenuity.

We have even gone further in this perverse direction. At Bradford and Rotherhithe (London), a system is in use by which the same water is used over and over again for 30,000 or 40,000 people without being renewed. The water is subjected to filtration and aeration, by a specially devised plant, about once a week. Very efficiently carried out this may rid the water of suspended inorganic or organic matter, but the question is whether it rids the water of dissolved organic matter. Bathing attendants know where this comes from. In any case the process is not one which becomes more attractive upon reflection, and is entirely unworthy of a nation which makes any claims to cleanliness.

Let us now discuss briefly the physical and educational results which may be expected from the introduction of spray baths into schools.

They will contribute in some degree to the decrease of infectious diseases propagated in schools, by raising the general standard of cleanliness and health, thus rendering the children less liable to contract infection. They will be effective in the struggle against verminous conditions in schools. Increased cleanliness and care of clothes and underclothing must invariably result in a consequent further improvement of the air in schools. Of further importance is the invigorating influence of spray baths in particular, suitably applied, and the consequent increased power of sustained mental effort. These are the benefits which will accrue to our school children during their school life. But the educative effect of shower baths will accompany the great majority throughout their lives. Cleanliness in body brings in its train cleanliness in surroundings, cleanliness in eating and drinking, and purity in all the functions of the body. Viewed in its ultimate aspects the introduction of shower baths will therefore in course of time prove of great value to the community in general and to the race as a whole.

In all schools where cleansing baths have existed for some time, there has been a noticeable improvement in the quality and cleanliness of the clothing of the children, and, generally speaking, an improvement too in self-respect. There is no doubt on the part of teachers as to the great benefits, both direct and indirect, which result from their use. One and all testify to this fact. This being so, we may confidently look for the co-operation of this great army of trained and devoted public servants, which, indeed, is absolutely necessary for the success of the movement.

Schools may be provided with the most excellent installations, but they will fail completely in their good effects if the bathing is carried out in a perfunctory and careless manner, owing to lack of intelligent appreciation and enthusiasm on the part of the teaching staff. Once the system is introduced it is to the teachers we must look for its thorough execution and final success. They must have full authority in the bathing premises over the bathing attendant and all the preparatory and bathing operations. Though not required to undertake any of the duties of the bathing attendants, their own share in the work must be clearly defined and understood, and their enthusiasm for a great national reform aroused. Their kindly tact will bridge over any initial difficulties such as the opposition of the parents, the water-shyness of the children at first, or their timidity amid the unwonted surroundings, and the unfamiliar

operation of douching. The work undertaken by the teachers in this respect will be amply repaid to them in the improved atmosphere and more agreeable surroundings which must inevitably result, and by the knowledge that they are assisting in a work of the greatest physical, mental and moral value to the children and the community in general.

LITERATURE.

The use of shower baths in schools in England and on the Continent. By Dr. F. Rose. Churchill, 7 Great Marlborough Street, London.—Price 1/-.

London County Council Report on school bathing arrangements in Germany and Holland (by Dr. James Kerr and Dr. F. Rose), with diagrams and tables.—Price 6d. King & Son, Great Smith Street, Westminster.

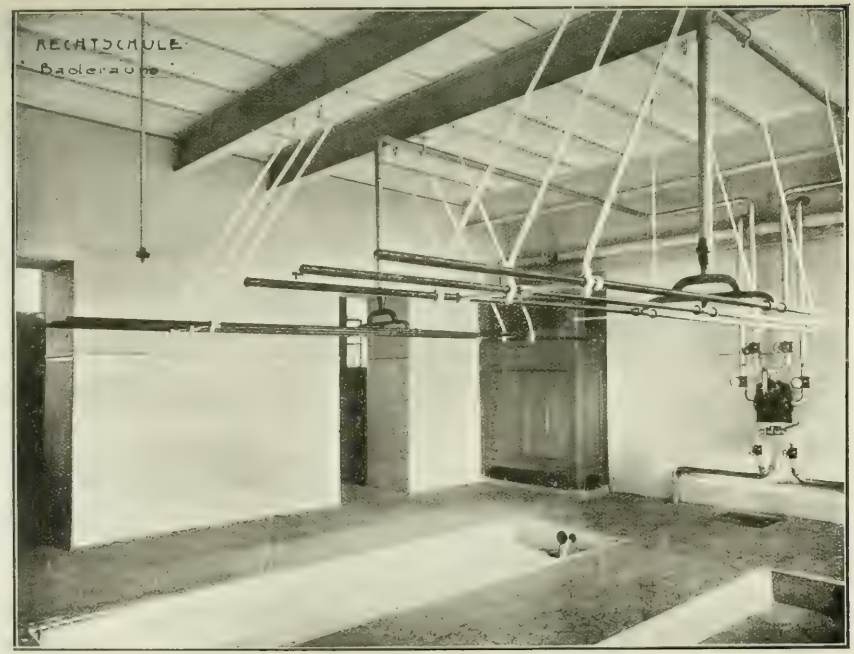
DR. EVANS (Glamorgan C.C.) said that of all the discussions in this school hygiene section, this he thought was of the most pressing importance.

The awakening of the health conscience was the first duty of school hygiene. It could never be awakened except at the school; cleanliness was at the very root of this question. The parents were ignorant of the most elementary rules of cleanliness.

School baths would soon reduce the skin disease that was so largely responsible for bad attendance. The question of expense must not be allowed to stand in the way of this elementary educational appliance—the school bath.

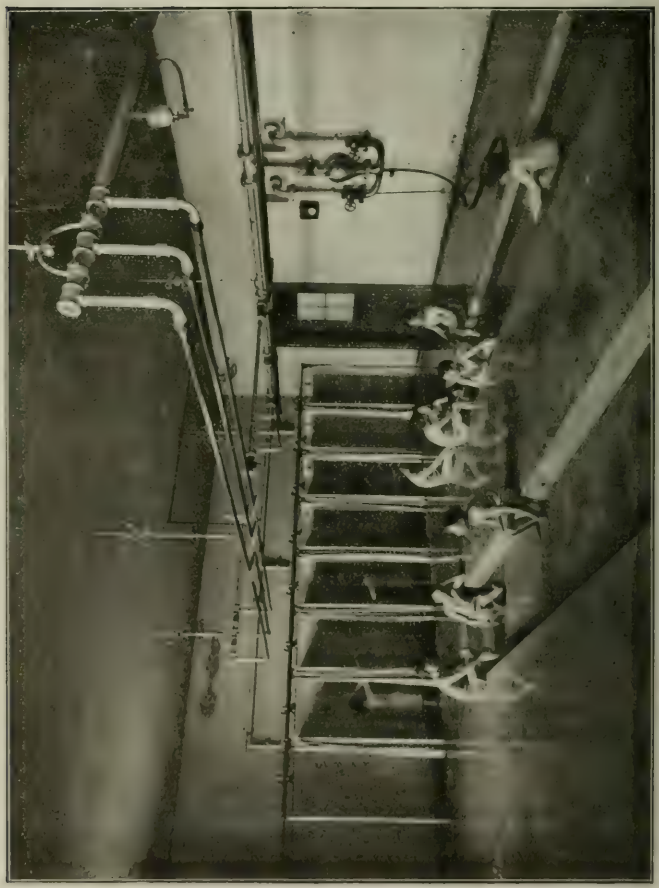
Shower-baths and foot-baths could be installed in every existing school, without very great additional expense, by taking up the room now used for cloak-rooms. That would get rid of the existing insanitary cloak-rooms, and cloak-rooms should be placed in open-air shelters, where the clothes would get aired and dried by the time the children came out of school.

PRINCIPAL GRIFFITHS, MR. FORD, and DR. F. ROSE also took part in the discussion.

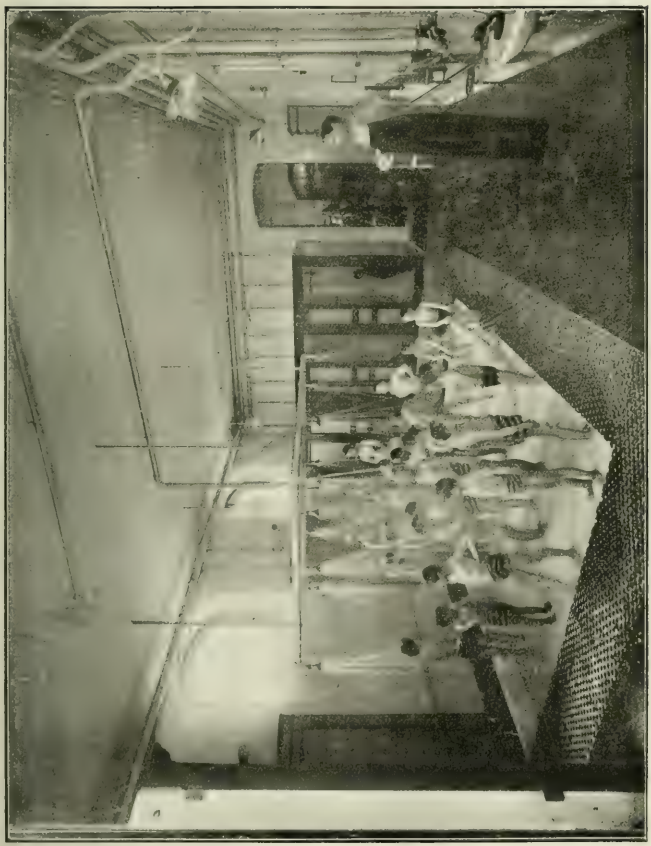


ELEMENTARY SCHOOL, COLOGNE.

SCHOOL SHOWER-BATHS.



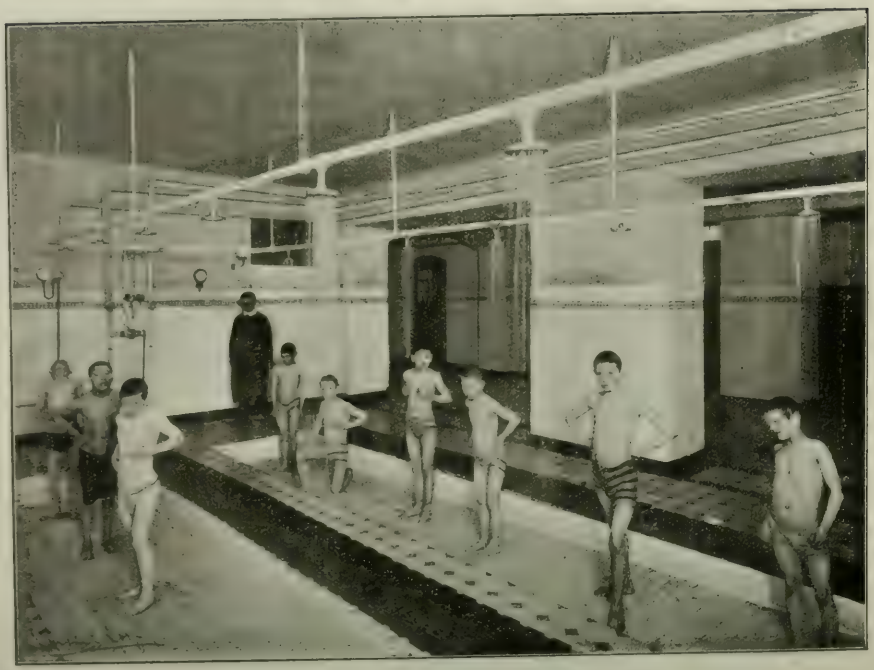
ELEMENTARY SCHOOL, MUNICH.



SCHOOL SHOWER-BATHS.

ELEMENTARY SCHOOL, NUREMBERG.

SCHOOL SHOWER BATHS.



ELEMENTARY SCHOOL, DÜSSELDORF.

Dr. J. Tatham Thompson, M.B., *read a paper on "Practical means of Prevention of Errors of Vision in School Children."*

The habit of short vision must be guarded against from the earliest stage of school life.

The principal factor in the production of short sight, is the protracted fixation of vision for near objects under an insufficient illumination.

Attention is therefore demanded to the amount of illumination and to the direction from which the light comes. Excessive illumination must also be avoided. Sunblinds and wall colouring.

In this country sufficient importance is not attached to the provision of proper school desks and seats. Both should be adjustable as regards height and distance, and the slope should be variable from 15° to 40°.

The near point of vision should not be less than 14 inches, to attain this a negative distance is essential. The height of the seat should be adjusted for each child so that the feet may rest on the floor or on a foot rest. Back supports are essential. Too narrow seats and desks to be avoided.

Councillor W. Baxter (Leeds) said that it was becoming a very serious question to parents that very many of their children were becoming affected in their sight. He had three grandchildren attending school: two out of the three, aged thirteen and twelve, were obliged to use glasses, the latter had been ordered to remain at home for six weeks on account of her sight.

Dr. D. A. Carruthers (Bucks C.E.C.) said that he would like to point out that it seemed to be usually the custom, whether from the lower grant or not he could not say, to give the infants the rooms in the school which were most badly illuminated, and Dr. Thompson had said that from four to seven were the years when myopia was most likely to occur, so this practice with the infants was laying the seeds of bad eyesight. He had also noticed that infants were often in their kindergarten hours given work to do which made them hold the object too near the eyes, and he therefore thought it was important that all such work should be on as large a scale as possible. Dr. Thompson had pointed out the necessity of adjustable desks for each child, but the Board of Education in their building regulations laid it down that they did not consider such desks necessary in elementary schools, and as the result of the enforcement of this regulation he would point out that the feeble-minded child, who was usually much larger than those with whom he sat on a form, had therefore more chance of having his eyesight affected, and this would not improve his condition.

Dr. Sommerville also took part in the discussion.

SCHOOL NURSERIES.

By W. LLOYD EDWARDS, D.P.H.,

School Medical Officer, Barry Education Authority.

(MEMBER.)

THE question as to whether the municipality should make any provision for children under the compulsory school age is one over which there seems to be wide divergence of opinion.

As with most problems of this kind we are bound to consider what is the present custom, and what has been done in the past. Hitherto, the general rule in England and Wales has been to send children to the infant school between the ages of three and five, though it will be seen that for the last few years the numbers of children attending school between three and five are steadily decreasing. This is largely due to the strong condemnation on the part of medical officers of health of the plan of sending children to school at so young an age.

The strongest argument against admitting them is undoubtedly the danger of infection. From the child's point of view it is certainly of benefit if the attack of measles or whooping cough be postponed for a year or two. The child will be better able to resist the disease and so increase its chances of recovery.

Another factor is the very heavy expense involved in teaching children under five, who roughly represent about one-tenth of the children in school, which might be utilised to better educational advantages if expended on children who are over five years of age.

That there is grave danger in placing children under five in school must be evident. It is hard to uproot old traditions, and the very name school implies efforts to force on the mental development of the child.

But there is far too much work done which is not only useless but harmful to the child. The children under five are subjected to rigid discipline, at far too early an age the teaching of reading is commenced, and formal lessons are given when the child's brain is not capable of appreciating them.

In the Board of Education's Report of Women Inspectors as to children under five, it is stated that "One can go any day into many infants' schools in London, and find during the so-called playtime rows of little children

sitting on a gallery in the baby room, some probably eating their lunch, without hearing one child speak or seeing one child happily playing. To the lover of little children this is suggestive of much."

If the question were simply as to whether children under five should be allowed into such schools there could be but one answer, and the harm done by such infant schools in the past must have been very great. Knowing these things the education authority of Barry definitely determined about ten years ago to alter the character of the infant schools, and more particularly the baby classes. The local circumstances were favourable, as all the school buildings were new and with good sanitary conditions. The staffing of the schools made it possible to have small classes similar to the kindergarten. A recent government return shows that in all the schools of Barry the number of certificated teachers per 1,000 children was 26·6, whilst the number of children in average attendance for each teacher in the infant school is under thirty. Added to this was the important fact that a liberal scale of salaries tempted well qualified teachers, and that the education authority provided facilities for and encouraged the kindergarten training of teachers on Froebelian lines. Indeed, a good proportion of the teachers of the youngest children had been trained in the kindergarten training colleges. The results were that for children under five all formal instruction was given up, and games, story telling, drawing and other kindergarten occupations which did not call for the finer movements on behalf of the child were substituted. In the report "on children under five," already quoted, it was stated of the Barry Schools, "The babies' rooms very nearly approximate to the type of nursery school really needed for children of this age." The discipline in the Barry Schools struck me forcibly "as being of the nature of the new spirit of school discipline existing in America. There is, too, in many of the schools of the boroughs named, *i.e.*, Barry, Cardiff, Newport and Swansea, a wider application of Froebelian principles producing kindergarten schools of the sensible type."

There is not the slightest doubt, therefore, that in these schools the evils attending the admission of children under five have been reduced to a minimum, but as it has entailed a considerable expenditure, the question will be asked as to whether there has been any resulting good.

Broadly speaking, the children may be said to be of two types: those who come from good homes, and those who come from bad homes. In estimating the results of school life upon the physique of the children there is endless difficulty in the way of comparison as to their physical conditions. So much depends upon the home life that it is useless to

attempt it, and yet for such young children that is really the only important feature that one ought to look for. With such young children, if I may paraphrase an "Alice in Wonderland" proverb: Take care of the muscles and the minds will take care of themselves. With regard to intellectual development, all we need concern ourselves about is whether school life for children under five has a retarding influence. With the help of the teachers I have recently made a careful examination of the children in the upper classes of the infant schools. As active brain growth does not usually set in until seven years of age, very little can be done in the direction of comparing mental growth. However, all children over six years of age were examined and generally the teachers' estimate taken in (1) reading, (2) number, (3) power of expression, (this included power of expression in manual work, drawing, etc.) The children were divided into three groups of children admitted at three, four, and five years, and marks were assigned in the usual way.

It was found that the children who entered at three years of age were slightly better in mental development than those who entered at five or over. With regard to those who entered at four, they were found to be almost equal or slightly inferior to those who entered at a later age. These facts seem at first sight contradictory until the character of the children is taken into consideration. The children who were kept at home until five were, as a rule, from good homes, whilst the children who entered at three included those who came from the lowest stratum. School life under good and rational conditions in these cases tended to equalize matters, whilst children drawn from a similar class who entered at four had not been long enough at school to counterbalance the inferior home conditions. The results showed little appreciable difference. This bears out exactly the opinion of most infant teachers that it is difficult to differentiate the children in the upper classes who entered late (*i.e.*, over five years) from those who entered at an earlier age. On these grounds, therefore, we can only come to the conclusion that intellectually there is not much benefit in admitting children under five.

There is therefore no need to make provision for all children under five, but there is a distinct need for such provision for a certain limited number, keeping in mind always that what is required is not exactly a school, but rather a nursery. For several reasons this should have an intimate connection with the school, though entirely separate from it. It is important that the elder children should be available to take the small children to and from the nursery, whilst the older girls could attend for practical instruction in the management of infants.

The experience of the infant schools in Barry tends to show that what is really required is a compromise between a kindergarten and a nursery. Indeed, with the sanction of the Board of Education and with a little change in organisation the experiment might be tried in some districts with but little change. It would be necessary to have the nursery entirely apart from the ordinary infant school, with separate cloak-room and lavatory accommodation so as to lessen the risk of measles and other infectious diseases. Moreover, it would be better that the nursery should be in charge of a properly qualified nurse who had some knowledge of kindergarten methods.

It has often been said that the minimum school age in every other country is higher than in this country, but it must be remembered that in every other country some substitute for the school in the case of young children has been found. In France and in Germany *crèches* have been established, whilst in many of the large towns of Australia, New Zealand, America and Japan free kindergartens have been established.

In Hungary, where the compulsory years of school life extend from six to twelve years and from twelve to fifteen years for continuation schools provision is made in the shape of *infant homes*. To these homes are sent all children between the ages of three and six, of whom proper care cannot be taken at home. The objects of the infant homes are to develop their physical skill, intellect and temperament suitably with their age, and to help them forward thereby in their physical, mental and moral development. They do this by means of manual occupations, fairy tales, conversations, singing and games.

They are, as laid down in the regulations, not teaching, but domestic and educating institutions. The hours are approximately the same as our infant schools, namely, three hours in the morning and two in the afternoon; and except in games the children are never brought together. It is distinctly laid down that the work differs from the Froebel system in so far that these homes do not excessively hinder the exercise of the child's will; do not overcharge the child's mind by forcing its capacities, but leave a wider scope on the child's freedom while protecting him from excessive demands upon his physical and mental powers. These homes are in model buildings, with hall for games, hall for work, playground, and covered play shed.

Very little has been done in this country. For some reason or other *crèches* have never been very successful. The London School Board started a few some years ago; and Dr. Kerr, in his first report to the London School Board, whilst stating that some arrangements should

be made for these nurseries to be conducted on sanitary lines, recommended that they be further developed and utilized for the home training of older girls. If we determine to admit a limited number of children under five, great care must be taken not to perpetuate the evils of the present system. With regard to the danger of infectious diseases, I am struck by the large number of children who have had measles before entering school.

At Barry I have asked for a return from every parent of every child in the schools, and though not able to give exact details, as these returns are not completed, I can see there is a large proportion of children who have had both measles and whooping cough before school life. Still, for all that, one must always remember this danger, and so the number in the school nursery must be limited. Ordinary day nurseries in this country usually contain from ten to sixty-five infants. Probably fifty may be taken as a suitable number. As our object is the physical well being of the child, the nursery should be very much of an open-air school.

The building should be airy and well lighted. The ventilation ought to be natural, and should allow of perflation by having windows on opposite sides of the room. If possible, a south aspect should be sought for, and there should be large French windows opening to a wide verandah, very much on the lines of an open-air sanatorium. Attached to the nursery should be a little lawn and garden; the interior fittings would be inexpensive.

Kindergarten chairs and tables, soft mattresses covered with a washable and removable material, a dado of black board around the walls for free drawing would be almost all that would be required, except that there should be facilities for bathing the children.

The nursery should be in charge of a motherly person with knowledge of kindergarten methods, and training in the nursing of children. As the number of children is to be limited a very small staff would be sufficient. Probably the best method would be to award maintenance scholarships to girls just leaving the primary schools, who have been through a housewifery course. This can now be done under the provision of the Education (Administrative Provisions) Act, 1907. If there were fifty children probably one nurse and two or three girls would suffice, but as the nursery would be a training school for these young girls several more girls could be admitted for training.

I find (as stated in Dr. Newman's book on Infantile Mortality) that in day nurseries the salaries usually paid are from 8 to 12s. per week for a nurse, while a girl would get from 3 to 5s. a week. Probably an amount equal to that paid to a pupil teacher would be enough for a maintenance

scholarship for girls whilst being trained. One of the advantages of having the nursery attached or near to a group of schools would be that the housewifery centre could be co-ordinated for the purpose of training in the management and care of children. In addition the girls would have lessons in nursing from the nurse, and hygiene lectures occasionally from the school medical officer.

With some such arrangement the school nursery could play an important part in improving the physique of the weakling children, and generally in preparing them for the infant school, whilst at the same time it would supply what is now very much needed, real practice for the older girls in the care and in the management of children.

The new regulations of the Board of Education which have now come in force reduce the number of girls allowed to attend demonstration classes in cookery and domestic subjects from 54 to 18. One result of this will be that the present cookery kitchens can be converted into combined laundry and cookery centres. It seems to me probable that many educational authorities will then take the combined domestic science subject and include housewifery: this will mean a demand for such nurseries as I have indicated.

So far, nothing has been done, I fancy, in this direction in connection with our primary schools, though at the Pestalozzi-Froebel Institute in Berlin this system is already working. There is a special department for the training of girls as nurses in charge of children, and in addition to training in cookery, laundry work, etc., they are allowed to practise in the *crèche* and the kindergarten attached to the Institute. The girls pay for their training, and I think the whole Institute is self-supporting. I am glad to find that a similar plan has now been started in this country. The Michaelis Free Kindergarten, which though entirely independent of the Froebel Educational Institute in London is intimately connected with it, has been opened, and the objects of the promoters are stated to be:—

(1) To see that the children are clean and adequately fed, and to train them in the habits of cleanliness.

(2) To occupy them indoors and out of doors in a manner suited to their childish years, thus adding to their happiness, intelligence and usefulness during childhood and in after life.

(3) To add to the progress to morality, order and freedom through the concerted action and general influence of kindergarten.

(4) To obtain the goodwill and co-operation of the parents, to acquaint them with the laws of human growth and development, and to help them to realize and fulfil their responsibilities with regard to their children.

The Free Kindergarten is near a poor and crowded part of Notting Dale and the children spend much of the time out of doors, doing gardening and playing in the sand pit. There is a bathroom, and the children have meals in the nursery.

Something of the same nature is the Ecole Maternelle in Paris. The children in such schools are under a very motherly woman and are cared for and fed, the parents paying the cost of the meals, where they are able to afford this. A recent article in "Education" described the children in these schools as being better cared for and not pinched, hungry and neglected in appearance as one sees in the poorer districts of London, Liverpool and Glasgow.

In order to start these school nurseries I do not anticipate there will be many difficulties to surmount. Already, I understand, the Board of Education has decided that there is no legal obstacle to prevent the establishment of a school nursery "which would be a species of infant school for children under five," and though every school has to be in charge of a certificated teacher the Board of Education expressly states that special permission will be granted to accept other qualifications instead of the teacher's certificate, which would be of little use in a nursery. Indeed we must, as far as possible, eliminate the teaching aspect in these nurseries and emphasize the play aspect.

We are slowly learning in this country what Pestalozzi and Froebel knew over a century ago, the great educational value of play: indeed, we might go further and say that it is the only form of education possible at the ages of the children who would be admitted into these nurseries. "To secure for her such physical training and exercise as may confirm her health and perfect her beauty," as Ruskin puts it in "Sesame and Lilies."

These school nurseries would be very different from the average infant school, and just as our hospitals serve the double purpose of alleviating suffering humanity and training nurses and medical students, they would train young girls in what, to many of them, will be the work of their lives.

Above all let there be no formal teaching, but a happy life to be spent mostly in the open air, so that the motto of the nursery to the children should be, "*Horas non numero nisi serenas*," only marking the sunny hours of their lives.

CLEANSING AND DISINFECTION OF SCHOOL BUILDINGS.

By W. HABGOOD, M.D.,

Medical Officer of Health, Sutton.

THE efficiency of any procedure for cleaning we may adopt will greatly depend on the surfaces we have to work on. If the floors and walls of the school be made of some impervious and smooth material, a daily application of cloths made damp with a solution of one of the many well known efficient antiseptics would be satisfactory.

If the desks and seats are of a hard wood with smooth surfaces and as few grooves and corners as possible they could be treated in the same manner. Once a week in the halls, the cross beams and stays could by aid of a ladder be carefully gone over, attention could be given at the same time to the windowledges, bookshelves, hot-water pipes and radiators. Once a month a sufficiently powerful machine would be used to force a spray over the ceilings and such other places as could not be easily reached by the other method. Even in a school where a case of infectious disease had occurred an immediate cleansing as above described would be sufficient. If perfect cleanliness were achieved disinfection would be unnecessary.

Careful attention should be given to the cloak rooms and hat pegs: but where the pegs are so close that garments and hats touch one another no amount of cleaning will prevent the spread of undesirable matter.

In buildings with floors constructed with boards and with rough walls perfect cleanliness is hardly obtainable. Probably spraying the walls rather than using a cloth would be more efficient, and some gentler way of assembling and dismissing the scholars in place of the heavy marching to music usually adopted would prevent a good deal of dust raising. Where the floor boards are old and shrunken the crevices must become filled with dirt, and the only treatment, short of reflooring, is that sufficient moist application be made to prevent the dirt rising as dust.

Most of this cleansing might form part of the daily drill. It would be exercise and relaxation for the scholars and at the same time an object lesson in sanitation.

Regarding materials used in teaching, I think all the pens and pencils

(seeing how often they are in the children's mouths) should be daily washed by them in a suitable disinfectant. Slates should be abolished. They are still used in many a village school. Drinking cups should not be provided, they afford too good a means for the dissemination of diphtheria, and water taps should be so placed that the children could not apply their lips to them, but should have to catch the water in the hollow of their hands. Their hands, true, may form but dirty cups, yet, by so drinking, children avoid one form of infecting their schoolfellows.

We have progressed in most places beyond the inhabitants of the East, but our method of acknowledging our entry upon holy, or healthy, places, by removing our hats does not seem to me so excellent a way as theirs of removing their shoes. As a practical people, regarding time as money, uncovering the head will hardly be discarded for the Eastern method, but for school children the wearing of stout slippers over unstockinged feet, and leaving these in the lobbies before entering the class-rooms, would save the introduction of a great deal of filth, result in the more frequent washing of feet, cause less suffering from cold feet and chilling due to damp boots, and raise less dust in the drilling carried out in the school when climatic conditions prevent the use of the playground.

Well, too, would it be if the children went hatless, as do the boys of Christ's Hospital, or, if that cannot be, that they keep their hats on their heads; for the close association of these articles of dress with one another in the lobbies is undoubtedly responsible for an emigration of their tenants most disheartening to the mothers who endeavour to keep such invasion from the heads of their children.

Are not we adults, men especially, even amongst the educated classes, guilty of carelessness in the matter of cleanliness of our clothing? Think of the life history of a favourite tweed suit or overcoat: how often it serves its owner for months, and perhaps years, without going through any process of cleaning, and, if the colour be right, even escaping the occasional brush: then, full of a varied assortment of germs, it descends to poorer brethren, until at last it reaches the rag-shop without having ever undergone any real cleaning since its issue from the hands of the tailor.

A quarterly visit of such clothing to the steam disinfector would be desirable, if not from an æsthetic point of view yet from a sanitary point, so long as we adopt the fashion of wearing unwashable clothing.

Mrs. M. E. Pillow *contributed a paper on "The Cleaning of Schools."*

NOTES ON LEGISLATION AND LAW CASES.

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LOCAL SANITARY AUTHORITY. — *Natural Stream — Pollution — Sewage Works — "Deterioration of the Water" — Injunction — Public Health Act, 1875 (38 & 39 Vict. c. 55), s. 17.*

According to the true construction of s. 17 of the Public Health Act, 1875, the water in a natural stream, the quality and purity of which is alleged to have been deteriorated by an effluent from a sewage farm, is not water of an arbitrary standard of purity and quality, but the actual water of the stream itself, into which the sewage or filthy water is conveyed.

Where a drainage board conveyed into an already polluted stream, at certain points, water "not freed from all excrementitious or other foul or noxious matter," and thus affected so as to deteriorate the purity and quality of the water of the stream at the points where such effluents were discharged:—

Held, that an injunction must be granted, at the instance of the Attorney-General, in the terms of s. 17 of the Public Health Act, 1875, to restrain such pollution.

It was the intention of the Legislature to provide that at no one point in the stream should offending liquor be conveyed into it, and it is no answer on the part of a drainage board to say that by discharging elsewhere into a polluted stream better effluents they have improved the quality of the water as a whole.

ATTORNEY-GENERAL v. BIRMINGHAM, TAME, AND REA DISTRICT DRAINAGE BOARD. Kekewich J. 551. Vol. II. Ch., November, 1908.

LONDON. — *Main Drainage System—Sewers—Storm-water Overflow — Discharge into Tidal Navigable Creek — Riparian Owners — Interference with private Rights — Trespass — Nuisance — Injunction — Metropolis Management Act, 1855 (18 & 19 Vict. c. 120), ss. 135, 150, 151—Metropolis Management Amendment Act, 1858 (21 & 22 Vict. c. 104), ss. 1, 2, 23, 24, 31.*

The plaintiff company owned large manufacturing works on both sides of a navigable tidal creek forming part of the Thames within the metropolis, and also the bed and banks of the creek subject to the public right of navigation therein. By the Metropolis Management Act, 1855, a brook which discharged into the creek and which had become an open sewer was with other sewers vested in the

Metropolitan Board of Works, the predecessors in title of the defendants, with power to alter, divert, or discontinue such sewers when necessary. By that Act and the Metropolis Management Amendment Act, 1858, the board were authorised and required to construct, according to such plans as should to them seem proper, all necessary sewers and works for the improvement of the main drainage of the metropolis and for preventing as far as practicable the sewage of the metropolis from passing into the river within the metropolis; but they were to cause the authorised works to be constructed and kept, and to exercise their powers of disposing of the sewage, so as not to create a nuisance. Under these Acts a vast system of sewers was constructed so as to carry the sewage down the Thames beyond the limits of the metropolis, and the brook in question was culverted and connected with a low-level sewer so that it no longer discharged into the creek. In 1907 the defendants, as part of the main drainage system and to relieve the pressure in the low-level sewer in times of heavy rains, erected a pumping station at the mouth of the creek, and when occasion required pumped the storm overflow into the creek. The storm-water was heavily charged with sewage matter, which adhered to the banks of the creek and created a nuisance:—

Held, that the defendants could not justify their acts on the plea that they were carrying out their statutory obligations, and that the plaintiffs were entitled to an injunction both on the ground of nuisance and (Kennedy L.J. doubting) on the ground of trespass.

Dixon v. Metropolitan Board of Works, (1881) 7 Q.B.D. 418, distinguished.

Price's Patent Candle Company v. London County Council. C.A., 526. Vol. II. Ch., November, 1908.

SEWERS. *"Sewer"—"Single private Drain"—Pipe receiving Drainage from Sewer—Connection with public Sewer—Local Government—Public Health Act, 1875 (38 & 39 Vict. c. 55), ss. 4, 31—Public Health Acts Amendment Act, 1890 (53 & 54 Vict. c. 59), s. 19.*

Several houses of different owners stood in a row and were drained in pairs: each house of each pair was drained by a separate pipe into a pipe common to both houses, and each of these common pipes discharged into a line of pipes laid in private ground which discharged into a public sewer. The "common pipes" were admittedly "sewers" within the Public Health Act, 1875:

Held, that the "line of pipes" which discharged into the public sewer was not "a single private drain" within the meaning of s. 19 of the Public Health Acts Amendment Act, 1890, and therefore that proceedings could not be taken under that section and s. 41 of the Public Health Act, 1875.

Decision of the Court of Appeal, (1907) 1 K.B. 182, affirmed on the above ground, and not upon the ground upon which that Court decided.

Wood Grees Urban Council v. Joseph. H.L. (E.) 419. A.C., Nov., 1908.

SEWERS.—*Facilities for carrying off Liquids from Factories—Local Government—Rivers Pollution Prevention Act, 1876 (39 & 40 Vict. c. 75), s. 7.*

By s. 7 of the Rivers Pollution Prevention Act, 1876, "every sanitary or other authority having sewers under their control shall give facilities for enabling manufacturers within their district to carry the liquids proceeding from their factories or manufacturing processes into such sewers . . . . provided . . . . that no sanitary authority shall be required to give such facilities as aforesaid where the sewers of such authority are only sufficient for the requirements of their district":—

Held (reversing the judgment of a Divisional Court (1908) 2 K.B. 341), that the word "sewers" in the proviso to the section refers not only to the pipes in which the sewage is received, but to the whole sewage system of the authority.

Guthrie & Co. v. Brechin Magistrates, (1888) 15 R. 385, not followed.

Brook v. Meltham Urban District Council. C.A. 780. Vol. II. K.B., October, 1908.

STREETS.—*Sewer—Satisfaction of Urban Authority—Evidence—Local Government—Public Health Act, 1875 (38 & 39 Vict. c. 55), s. 150.*

In a road which was a street within s. 150 of the Public Health Act, 1875, but which was not a highway repairable by the inhabitants at large, an urban authority in 1881, at the cost of the rates, constructed a sewer for soil only, the surface water from the road and the adjoining houses, both before and after 1881, being carried away by channels at the side of the road. In 1904, there having been no change since 1881 in the number or character of the adjoining houses, the urban authority gave notice under s. 150 to the frontagers in the road to construct a sewer in the road for the purpose of carrying away the surface water. The frontagers, contending that the road was not a street not sewered to the satisfaction of the urban authority within s. 150, did not comply with the notice, and on their default the urban authority themselves constructed the sewer and sought to charge the expense on the frontagers.

Held, that it was a question of fact for the justices whether the road was a street not sewered to the satisfaction of the urban authority, and that the fact that the urban authority had themselves constructed a sewer in the road in 1881, and had done nothing further with regard to the drainage of the road until 1904, did not as a matter of law preclude the justices from finding as a fact on the evidence that in 1904 the road was not sewered to the satisfaction of the urban authority.

Bloor v. Beckenham Urban District Council. Div. Ct. 671. Vol. 2 K. B. September 1908.

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1909.

ABSTRACTORS OF TITLES OF ARTICLES RELATING TO PUBLIC HEALTH.

H. Adams, M.Inst.C.E.

Bushell Anningson, M.A., M.D.

Prof. H. R. Kenwood, M.B., D.P.H.

C. Mason, Assoc.M.Inst.C.E.

G. Reid, M.D., D.P.H.

H. A. Roechling, Assoc.M.Inst.C.E.

J. Osborne Smith, F.R.I.B.A.

W. Whitaker, B.A., F.R.S., F.G.S.

The Institute is not responsible for the facts and opinions advanced in the Addresses, Papers, and Articles published in the Journal.

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THE ROYAL SANITARY INSTITUTE.

REVIEWS OF BOOKS.

A Plumbing Catechism.*

This little book is divided into sections under the headings Plumbing Fixtures, Water-service Pipes, the Design of Pipe Systems, Pumps, and the effects of Freezing; the information being given in the form of answers to specific questions. The authors are both members of the American Society of Inspectors of Plumbing, etc., and are doubtless well informed in American practice. They, however, do not appear to be in touch with the best English practice. As examples: the references to painted cast-iron sinks (page 14); to grease-traps (p. 17); the use of galvanised iron tanks in preference to those made of lead for storing water (p. 47); galvanised wrought-iron soil-pipes (p. 58); the use of oakum for calking cast-iron and of earthenware pipes (pp. 61 and 63); a minimum thickness of $\frac{1}{8}''$ for 4″ cast-iron soil pipes (p. 60); the omission of trapping the bottom ends of rain-water pipes under certain conditions (p. 70): are a few of the details which are not held to be good practice in this country. It is difficult, too, to understand how a trap can be rendered proof against siphonage by having a deep water seal.

Speaking generally, there is some doubt as to whom the book is intended to appeal. In the preface it states: "It has been the purpose of the authors in compiling this book to so formulate the basic principles of plumbing design and practice as to crystallise the knowledge of the skilled plumber, and provide to the non-technical reader a source of information on this subject as free as possible from the puzzling set phrases of the craft." The book deals largely with "set phrases of the craft" which are intelligible only to professional readers. In the absence of any illustrations those who have no knowledge of sanitary works and fittings would have a difficulty in appreciating the advice it contains. Those, however, who are cramming for an examination may pick out a few aids to a successful passing.

The book is strongly bound, well printed on good paper, contains 84 pages of text and a copious index, and is of a size convenient for carrying in the pocket. The price of one dollar, however, appears to be rather high for so small a book when it is compared with the cost of some of our English treatises on the same subject. J. W. C.

Physiology for Beginners.†

The authorship of this excellent little work and the fact that it has been reprinted nine times since 1894, when it was first published, are sufficient

* A Plumbing Catechism, or the Theory and Practice of Plumbing Design in Question and Answer. By Chas. B. Ball, M.Am.Soc.C.E., Member American Society Inspectors of Plumbing and Sanitary Engineers; and H. T. Sherriff, A.B., editor of *Domestic Engineering*, Member American Society Inspectors of Plumbing and Sanitary Engineers. *Domestic Engineering*, Chicago.

† Physiology for Beginners, by Sir Michael Foster, K.C.B., M.D., F.R.S., and Lewis E. Shore, M.D. 266 pp. London, 1907. Macmillan & Co. Price 2s. 6d.

testimony of its worth, without further recommendation. Not the least valuable part of the work is found in the first two chapters, which are devoted respectively to chemical and physical facts bearing upon physiology, and some account of the vital phenomena of plants and animals.

The illustrations, chiefly diagrammatic in character, are either original, or borrowed (with consent) from such works as Prof. Huxley's "Elementary Manual of Physiology" and Prof. Mivart's "Elementary Anatomy."

The book is admirably clear and concise, and extreme opinions upon moot points are studiously avoided. The paragraphs on "A purely Vegetable Diet" and "Alcoholic Beverages" furnish excellent examples of this judicial moderation, as the following extracts will show:—

"Man can adapt himself to a purely vegetable diet, and in fact many races live exclusively on such food: but a mixed diet, one containing some animal proteids and fats, is under ordinary circumstances the best.

"There is no doubt that a certain quantity of alcohol is injurious and interferes with all the functions, and ultimately brings about various diseases, but it does not follow from this that in smaller quantity it may not be harmless or even beneficial.

"The limit up to which any beneficial effects are produced is soon reached, and beyond this it only does harm. This limit is not the same for all individuals.

"The effect of alcoholic beverages does not depend solely on the ordinary alcohol in them, for other substances which they contain often have powerful actions in the body.

"In some cases of disease alcohol may be of great service, but in health it cannot be considered a necessity, and is far more potent for evil than for good."

The book is a complete résumé of up-to-date elementary physiology, and will doubtless retain the high place in the opinion of teachers which it has always hitherto occupied. P. B.

Report of the Education Committee of the London County Council.*

It is doubtful whether there is any more valuable publication upon school hygiene than Dr. Kerr's annual Report.

It contains careful records of observations made by a staff of trained experts who have an unrivalled field for their investigation. The observations and experiments are concerned not merely with the matters which usually come under the ken of the school sanitarian—ventilation, lighting, infectious diseases—but with matters like word-blindness, word-deafness, the stages in the development of speech, fatigue as affected by school conditions, racial differences as affecting growth, etc., etc. The report, therefore, is a storehouse of facts, suggestions and methods. It should be carefully studied not only by medical officers of health, but by all who are interested in the great task of placing education upon a thoroughly scientific foundation.

Inspectors of schools, heads of training colleges, professors of education, members of Parliament, will find in these pages well-arranged and carefully tabulated facts which must prove of the utmost importance in discussing national education in regard to national health.

In view of the medical inspection of school children soon to be initiated, the

* Report of the Education Committee of the London County Council, submitting the Report of the Medical Officer (Education) for the year ending 31st March, 1907

sections dealing with the Examination of Infants, and the Inspection of Secondary Schools and Training Colleges (pp. 6–10), will to many have a special interest.

Dr. Kerr's statement that "it is of special importance to have children examined at the ages of three to five years, to detect the beginnings of diseases" (like tubercular, bone and joint diseases), may have some influence in modifying public opinion as to the age when school attendance should begin.

It is made evident that medical inspection "means sooner or later the establishment of school clinics for treatment in quite restricted and defined ways." A weekly clinic was instituted at the Head Office for the detailed examination of various difficult cases, and greatly simplified and relieved administrative treatment.

The medical inspection of secondary schools seems already to have been fruitful of practical results. Head teachers in some of the girls' schools "feel the great help of medical examinations. They have altered time-tables, arranged special classes, and made individual arrangements to suit particular pupils according to the doctor's advice." It is worth noting that "the most striking fact brought out by the medical inspection seems to be ignorance of the ordinary elementary rules of health. With these girls a course of hygiene should take a leading and prominent position in the school."

Extraordinary care has been taken with the statistics of growth of London children, and the method of arriving at the careful records of height and weight is so clearly stated that others may be able to draw up similar tables for different districts, and a really reliable series of records for comparison may be looked for at an early date. The diagrams enable the reader to see the results at a glance.

The sections dealing with dental conditions, spinal curvature, pulmonary tuberculosis, tonsils, and adenoids are not mere statements of dry facts, but are important additions to our knowledge of these subjects, and contain valuable suggestions as to their practical treatment.

The series of observations on the effect of ventilation on school fatigue gives some curious results, *e.g.*, that slight fatigue seems to improve the capacity for mental work, but we have not space to do more than call attention to them. The two pages about fatigue and rifle-shooting tests (pp. 29, 30) are of great educational interest.

The inquiry on the development of speech which has been started by Dr. Ernest Jones promises to supply the educationist with data of great importance, and if the mental factors of speech can also be investigated the results will afford fresh light upon stages and methods of linguistic education. Altogether this report, like its predecessors, is a volume of real scientific value, and of national interest. J. E.

Land Treatment of Sewage.*

The Royal Commission on Sewage Disposal was appointed just ten years ago to inquire and report on the methods for treating and disposing of sewage, and although the Commission has from time to time issued various voluminous blue-books, much disappointment still prevails, as they afford little practical information for the assistance and guidance of the many town councils, sanitary authorities, civil engineers, and others interested, who have been anxiously looking forward to the results of their labours.

* Land Treatment of Sewage: A Digest of the Reports made to the Royal Commission on Sewage Disposal by their specially appointed Officers. 76 pp. London, 1907. *The Surveyor and Municipal and County Engineer.* Price 5s.

The great centres of population throughout the United Kingdom remain pretty much as they were, their sewage being still but partially dealt with, while large sums of money continue to be spent on experimental works.

It is refreshing, therefore, to find Mr. H. T. Scoble, in his book, making some effort to draw information from those blue-books which might be of some practical benefit. Mr. Scoble has given his attention mainly to the Fourth Report, Vol. IV., parts i. to iv., which was issued in 1904, and he condenses its 787 closely-printed pages considerably, his own book numbering but 76 pages of clear and open print.

The subject of sewage treatment has undoubtedly of late lapsed far too much into the region of theory, and Mr. Scoble deserves credit for endeavouring to treat it from a more practical point of view.

Among the points quoted by Mr. Scoble it may be well to note the conclusion of the first Sewage Commission, which reported in 1865, after eight years of investigation, as follows:—"The right way to dispose of town sewage is to apply it continuously to land, and it is only by such application that the pollution of rivers can be avoided."

Nearly half a century has elapsed since that conclusion was arrived at, but the first portion of it is as true to-day as it was then; and, provided that all the conditions are favourable, there is no better way of treating sewage to-day than by applying it to land. It has been the reckless disregard of local conditions, and the application of sewage to land whether those conditions were suitable or not, which has brought this method into such disrepute during all these years, and Mr. Scoble has done a great public service in emphasising that fact.

It is true that, since the 1865 First Report of the Royal Commission, very considerable advance has been made in the matters of adjuncts to treatment on land. In the first place, chemical treatment of sewage by precipitation has been and is in many instances successfully employed; also that during recent years, as Mr. Scoble points out, "The advent of bacterial processes for the purification of sewage has had far-reaching effects: not only have many installations been erected throughout the country, but attention has been redirected to land treatment. It is now clear that much of the work performed in the land is due to bacteria, and sewage farms need no longer be conducted by rule-of-thumb methods."

The progress, too, which has been made in bacteriological investigations since the First Report in 1865 has resulted in leading engineers to a more efficient manner of constructing and using artificial filters for sewage effluents. The progress in this direction cannot be overrated, inasmuch as by the employment of properly designed and constructed and properly used filters, it is now quite practicable to dispense with land treatment in cases where it is not possible to obtain land having the necessary area and suitable conditions. All these points are embodied in Mr. Scoble's book, but space does not permit here of quoting more fully from his work.

Mr. Scoble is to be congratulated upon this recent contribution to sewage literature, which will repay the careful attention of the sanitary engineer, who will find in it a safe guide; and if, in the future, the engineer will strictly confine his attention to local conditions, as well as local circumstances and requirements in each case upon which he is called to advise, bearing in mind that there is no one method *per se* for the treatment of sewage, but in most instances a combination of methods, and that scarcely two cases can be dealt with alike, he will avoid a repetition of the many failures hitherto and advance the practical treatment of sewage more than has been the case for many years past. Above

all, he should avoid the too oft made mistake of trying to effect sewage treatment at too small an outlay in money for construction of adequate works and for their efficient management afterwards. J. C. M.

Irrigation.*

The art of the civil engineer, directing "the great sources of power in Nature for the use and convenience of Man," has probably been exercised for a longer period on irrigation than in any other direction, and the latest book on that branch of engineering is well worthy of study wherever rainfall is deficient or cannot be depended upon to supply at all times the demand of plant life for moisture, and where under-drainage, either natural or artificial, can enable vegetation on any land to profit from a bountiful supply of water.

Provided the latter condition of good drainage exists, the supply of water alone will increase the crops grown on any land, and if the source of supply be a river like the Nile in Egypt, bearing silt or other manurial matter in suspension or solution, the farmer is doubly benefited by distribution of a fertilising stream over his fields. This fact was recognised long ago, as is testified by existing traces of extensive works of irrigation, and of the populations which could only have been supported by the fruits of such irrigation on the sandy plains of Asia and Egypt.

During the last fifty or sixty years the Indian Government, stimulated by frequent famines, has carried out magnificent irrigation works and a school of engineers, who, becoming experts in the construction and maintenance of those works in India, have, under Lord Cromer's government, brought Egypt to her present prosperous condition—but Australia, South Africa, and, later on, perhaps Asia Minor also—will afford ample scope for the irrigation branch of engineering in the future.

There is present need therefore of such a work as that undertaken by its author, "to collect in small compass the principles on which irrigation engineering is based, illustrated by examples of their being put in practice in India and Egypt with which he has been personally connected."

Beginning with basin irrigation, in which land adjoining a river is submerged by its water in time of floods only, when little control can be exercised as to quantity and duration of the irrigation, we advance to a system by which a river is dammed up by regulating works, and branch and distributory canals lead its water even to distant lands, which can thus be watered at all seasons to the best advantage, as in the case of the Assouan dam and reservoir on the Nile.

It is thus that modern science comes in, and the author well describes the principles and the difficulty of adapting them to local conditions so as to secure the maximum of beneficial results from the necessarily heavy outlay required for the construction of permanent irrigation works, because the water should be kept moving in the reservoir and in the canals sufficiently to prevent deposit of silt until it has reached the fields, where its rate of flow must be checked to favour deposition of silt, but absolute stagnation must be avoided as, in all cases, prejudicial to plant growth.

A too rapid flow in the canals, on the other hand, would cause scour and injury to the channel, whence it becomes necessary to calculate the area of land requiring water, the probable volume of the latter, and to arrange sections and

* Irrigation, by Sir Hanbury Brown, K.C.M.G., M.Inst.C.E., late Royal Engineers. 307 pp. London, 1907. Archibald Constable & Co., Ltd. Price 30s.

gradients which will give the requisite velocity in the several branch and distributing canals according to their several "duties" thus determined.

The construction of river dams is discussed, with numerous examples which have come under the author's observation, and the opinion is expressed that, for India, the best form of regulator is a weir, raised but little above the river bed, with movable shutters on its crest worked from a bridge overhead, or self-acting ones, which collapse when the flood reaches a certain level and can be erected again by hand when the river is low again as in the case of the weir of the River Sone. A. S. J.

ARTICLES RELATING TO PUBLIC HEALTH,*

Appearing in the chief British and Foreign Journals and Transactions.

Abstracts of Titles classified in this List under the following headings :—

Science in Relation to Hygiene and Preventive Medicine.
Hygiene of Special Classes, Trades, and Professions; and Municipal Administration.
Building Materials, Construction, and Machinery.
Water Supply, Sewerage, and Refuse Disposal.
Heating, Lighting, and Ventilating.
Personal and Domestic Hygiene.

The articles referred to in this list are as far as possible collected and filed in the Library of the Institute for the use of the Members and Associates.

Building Materials, Construction, and Machinery.

"Engineering Record." The John W. Ferguson Co. Instructions for Foremen. 23rd Nov., 1907, p. 575.

A copyrighted manual of rules for Construction Foremen.

Water Supply, Sewerage, and Refuse Disposal.

——— Experimental Purification of Boston Sewage. 30th Nov., 1907, p. 607.

Abstract of a paper by Messrs. Winslow & Phelps of the Sanitary Research Laboratory and Sewage Experiment Station of the Massachusetts Institute of Technology.

——— The Filtration of the Croton Water Supply of New York. 23rd Nov., 1907, p. 561.

Illustrated description of the settling tanks and 42-acre filter beds, in ferro-concrete construction.

——— The Sterilisation of Treated Sewage. 16th Nov., 1907, p. 547.

Experiments on the germicidal effect of copper upon sewage effluents of different qualities.

* Members or Associates wishing to file or catalogue these Titles can, on application, be supplied with excerpt copies for this purpose.

MEETINGS HELD.

Examinations.

The following Examinations have been held :—

Examination Qualifying for Membership.

Plymouth, Jan. 25th..... 1 candidate; No certificate granted.

Sanitary Science as applied to Buildings and Public Works.

Hong Kong, Oct. 28th and 30th, 1907 1 candidate: 1 certificate granted.
Plymouth, Jan. 24th and 25th..... 1 candidate: 1 certificate granted.

Inspectors of Nuisances.

Hong Kong, Oct. 28th and 30th, 1907 6 candidates: 4 certificates granted.
Plymouth, Jan. 24th and 25th..... 23 candidates; 13 certificates granted.

Candidates who have received Certificates.

Sanitary Science as applied to Buildings and Public Works.

Parker, Alex. Vernon. Perkins, Samuel Barclay.

Inspectors of Nuisances.

Anderson, Frances Amabelle.
Boyd, Samuel Robert.
Brett, Charles Walter Thornton.
Gale, Harry.
Govett, Philip Brenton.
Hutton, John, *Sergt-Maj.*, R.A.M.C.
Metherell, Alfred.
Pellow, James.
Revell, Wilfred George.
Slater, Percy Henry.
Seaton, Cicely Maud.
Seaton, Dorothy Lilian.
Thomas, Llewellin James.
Tolcher, William Henry.
Wardle, Alice.
Willis, George.
Wiltshire, Leonard John.

FORTHCOMING MEETINGS.

Congress and Exhibition, 1908.

The Congress will be held at Cardiff, July 13th to 18th, under the presidency of the Rt. Hon. the Earl of Plymouth, C.B., P.C., D.L., J.P., Lord-Lieutenant of Glamorganshire.

Lecture to the Institute.

"The Results of Sanitation in the Efficiency of Armies in Peace and War." Owing to the illness of Surgeon-General Sir Arthur Keogh, K.C.B., M.D., LL.D., Director-General, Army Medical Service, the date cannot be definitely arranged at present.

Sessional Meetings.

London, Wednesday, February 12th, at 8 p.m. Discussion on "Rivers Pollution, with special reference to the Board proposed by the Royal Commission," to be opened by Sir William Ramsay, K.C.B., LL.D., D.Sc., Ph.D., F.R.S.

Nottingham, Saturday, February 15th, at 11 am. Discussion on "Present-day Road Requirements in Town and Country," to be opened by E. Purnell Hooley, M.Inst.C.E., County Surveyor, Nottinghamshire. Visits will be made to Corporation Works and Ways Depot and to inspect the various types of road paving in and about the city.

Blackpool, March 13th, at 7.30 p.m. Discussion on "Sewer Ventilation and the Intercepting Trap," to be opened by F. J. H. Coutts, M.D., B.Sc., D.P.H., F.C.S., Medical Officer of Health for the County Borough, and J. S. Brodie, Assoc.M.Inst.C.E., Engineer and Surveyor for the County Borough. On Saturday, March 14th, visits will be made to the Destructor and Electricity Works, Infectious Disease Hospital, etc.

Annual Meeting of Associates.

London, Tuesday, March 24th. In the Parkes Museum, at 8 p.m. Address by H. Percy Boulnois, M.Inst.C.E., on "House Refuse, Collection and Disposal."

Examinations.

In Sanitary Science as applied to Buildings and Public Works, for Inspectors Qualifying for Membership, for Inspectors of Nuisances, in Hygiene in its Bearing on School Life—

Hull, Feb. 21st and 22nd. *Blackburn*, Feb. 28th and 29th.
Hereford, March 20th and 21st.

Inspectors of Meat and other Foods—

Glasgow, February 7th and 8th. *Hull*, March 6th and 7th.

Students' Lectures.

Sanitary Officers.

The Forty-fifth Course of Lectures and Demonstrations to Sanitary Officers will commence on Monday, February 17th. The Lectures include the subjects scheduled for the Examinations held by The Royal Sanitary Institute and the Sanitary Inspectors Examination Board (formed by The Sanitary Institute and other bodies).

Sanitary Science as applied to Buildings and Public Works.

A Course of Lectures and Practical Demonstrations has been arranged to assist those wishing to obtain the Certificate of the Institute in Sanitary Science as applied to Buildings and Public Works, commencing on February 26th.

Hygiene in its Bearing on School Life.

This Course of Lectures, commencing on March 2nd, has been arranged to assist Teachers and others interested in the training of children and the structural conditions of the School, who purpose entering for the Examination of the Institute.

Practical Training for Meat Inspectors.

The Twelfth Course will commence on February 21st, and will consist of systematic Practical Training in the Inspection of Meat at a Cattle Market, including Demonstration on live cattle and sheep, slaughtering

and dressing of animals, names and situations of the organs, diseases of animals, methods of stalling, arrangements of markets and byres, etc., and will include the Lectures on Meat and Food Inspection given in the Parkes Museum, Demonstration and Inspection at Fish Market, and Inspection and Demonstration at a Knacker Yard.

Special Course on Food and Meat Inspection.

Seventh Special Course for Commissioned Officers and Professional Men preparing for the Examination for Inspection of Meat and Other Foods, will commence on April 27th.

The dates and subjects of the Lectures and Demonstrations in each Course are given month by month in the Calendar.

Calendar, February and March, 1908.

As far as at present arranged.

Council Meetings are held Monthly on the Second Wednesday in each Month and the Standing Committees in the preceding week.

Exhibition Committee Congress and Editing Committee	Monday in the week preceding the Council, at 4.30 p.m. & 5.30 p.m.
Examination Committee Museum and Library Committee	Tuesday in the week preceding the Council, at 4 p.m. and 5 p.m.
Special Purposes Committee Finance Committee	Wednesday in the week preceding the Council. at 4 p.m. and 5 p.m.
Parliamentary Committee New Premises Committee	As occasion requires.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

Council and Committee Meetings are suspended during August and September, and the Museum and Library are closed on Public Holidays.

FEBRUARY.

6 Th. Public Meeting re Congress at Cardiff at 3.30 p.m.

7 F. } Examination for Inspectors of Meat and other Foods, Glasgow.
8 S. }

12 W. **Sessional Meeting,** London, at 8 p.m. Discussion on "Rivers Pollution, with special reference to the Board proposed by the Royal Commission," to be opened by Sir William Ramsay, K.C.B., LL.D., D.SC., PH.D., F.R.S.

15 S. **Sessional Meeting,** Nottingham, at 11 a.m. Discussion on "Present-day Road Requirements in Town and Country," to be opened by E. Purnell Hooley, M.INST.C.E., County Surveyor, Notts C. C. Visits will be made to the Corporation Works and Ways Depot, and Inspections of various types of road-paving in and about the city.

17 M. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, A: Introductory Remarks, Public Health Acts—English, Scotch, Irish; other Statutes relating to Public Health; By-laws (Model, etc.), Regulations, Orders, Memoranda, etc., by J. Priestley, B.A., M.D., M.R.C.S., D.P.H., M.O.H. Lambeth.

19 W. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, B: Public Health (London) Act; Metropolis Local Management Acts; By-laws and Regulations in force in the Administrative County of London, by J. Priestley, B.A., M.D., M.R.C.S., D.P.H.

21 F. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, C: Factory and Workshop Acts (including Bakehouse Legislation, 1878-95) as they affect the Sanitary Inspector: Smoke Legislation; Food and Drugs Acts, 1899, by J. Priestley, B.A., M.D., M.R.C.S., D.P.H.

21 F. Lecture—Meat Inspectors' Course, at 6.30 p.m.

21 F. / 22 S. Examinations—Hull.

24 M. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—General, A: Outdoor, by A. Wellesley Harris, M.R.C.S., D.P.H., M.O.H., Lewisham.

25 T. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—General, B: Indoor, by A. Wellesley Harris, M.R.C.S., D.P.H.

26 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

28 F. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—C: Offensive Trades and Trade Nuisances, etc., by A. Wellesley Harris, M.R.C.S., D.P.H.

28 F. / 29 S. Examinations—Blackburn.

29 S. Demonstration—Meat Inspectors' Course, at 2 p.m.

29 S. Inspection and Demonstration in the District of Chiswick, at 3 p.m. Conducted by J. H. Clarke, Chief Sanitary Inspector.

MARCH.

2 M. Lecture to Sanitary Officers at 7 p.m. "Infectious Diseases," by Prof. A. Bostock Hill, M.D., M.SC., M.O.H. Warwickshire C. C.

3 T. Lecture to Sanitary Officers at 7 p.m. "Methods of Disinfection," by Prof. A. Bostock Hill. M.D., M.SC.

4 W. Inspection and Visit to Common Lodging House, Kemble Street, Drury Lane, W.C., at 2.30 p.m.; and at 4 p.m. Inspection of Messrs. Callard, Stewart, and Watt's Bakery, Little Dean Street, Soho, W.

4 W. Lecture to Sanitary Officers at 7 p.m. "Elementary Statistics," by Prof. A. Bostock Hill, M.B., M.SC.

5 Th. Lecture to School Teachers at 7 p.m. "Physiology," by Prof. H. R. Kenwood. M.B., D.P.H.

5 Th. Demonstration of Book-keeping as carried out in a Sanitary Inspector's Office, at the Public Health Office, Town Hall, Upper Street, Islington, N., at 7 p.m., by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

5 Th. Lecture—Meat Inspectors' Course at 6.30 p.m.

6 F. Lecture to School Teachers, at 7 p.m. "Physiology," by Prof. H. R. Kenwood, M.B., D.P.H.

6 F. Lecture to Sanitary Officers at 7 p.m. "Elementary Science: Physics, Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

6 F. / 7 S. Examination for Inspectors of Meat and Other Foods, Hull.

APRIL.

15. W. **Ordinary General Meeting,** at 4.30 p.m.

MAY.

12 T. **Annual Dinner of the Institute.** at the Langham Hotel, The President, His Grace the Duke of Northumberland, in the chair.

JULY.

13 22. **Congress and Exhibition, Cardiff.**

LIST OF HON. FELLOWS, MEMBERS AND ASSOCIATES ELECTED,

JANUARY, 1908.

HONORARY FELLOWS.

Reg No.	Date of Election.	
[illegible]	1908. Jan.	BADALONI, Professor Dott Cavaliere Giuseppe, *Via Sallustiana 10, Rome.*
[illegible]	1908. Jan.	BURGERSTEIN, Professor Dr. Leo, *Burgerspitalgasse 28, Vienna.*
	1908. Jan.	CHLOPINE, Professor G. W., *St. Petersburg, Russia.*
[illegible]	1908. Jan.	GRIESBACH, Professor Dr. H., *Mulhausen, Els.*
[illegible]	1908. Jan.	KIRCHNER, Professor Dr., *Landshuterstrasse 35, Berlin, W.*
	1908. Jan.	MATHIEU, Dr. Albert, 37, *Rue des Mathurins, Paris.*
[illegible]	1908. Jan.	MISHIMA, Professor Dr. M., M.D., *Principal Medical Officer, Ministry of Education, Tokyo, Japan.*
[illegible]	1908. Jan.	PAGLIANI, Luigi, *Professor of Hygiene, University of Turin, Italy.*
[illegible]	1908. Jan.	PALMBERG, Professor Dr. Alb., *Helsingfors, Finland.*
[illegible]	1908. Jan.	PINCHING, Sir Horace Henderson, K.C.M.G., M.A., L.R.C.P., M.R.C.S., *Director-General, Public Health Department, Cairo, Egypt.*
[illegible]	1908. Jan.	RUFFER, Marc Armand, C.M.G., M.A., M.D., B.CH., F.L.S., F.S.S., *Ramleh, Egypt.*

MEMBERS.

* Marked thus have passed the Examination in Sanitary Science as applied to Buildings and Public Works.

M Marked thus have passed the Examination of the Institute for Inspectors of Meat and Other Foods

‡ Marked thus have passed the Examination for Inspectors of Nuisances.

[illegible]	1908. Jan.	*‡BALDWIN, Ernest Wilfred, 35, *Kingswood Road, Wimbledon, Surrey.*
[illegible]	1908. Jan.	*BEECH, Harry, 55, *Sixth Avenue, Manor Park, Essex.*
[illegible]	1908. Jan.	*‡BUTLER, Stanley George Montague, *Hook, Winchfield, Hants.*
[illegible]	1908. Jan.	‡BUXTON, Anthony, *Illawarra, Totland, Isle of Wight.*
[illegible]	1908. Jan.	CROPPER, Richard Blaylock, F.A.S.I., *Municipal Offices, Liverpool.*

2372 1908. Jan. ‡FORTUNE, Sidney Herbert, P.A.S.I., *Hankley, Villa, Oldfield Park, Bath.*

2373 1908. Jan. HUNTER, Miss Marian, L.S.A., D.P.H., 21, *Thurloe Square, S.W.*

2374 1908. Jan. JENKINS, J. D., M.D., B.S.LOND., D.P.H., M.R.C.S., L.R.C.P., (*M.O.H.*), *Bryngolen, Ystrad, Rhondda, Glam.*

2375 1908. Jan. *JONES, Arthur Edward, 2, *St. Mark's Square, Regent's Park, N.W.*

2376 1908. Jan. *KIRK, Allan, P.A.S.I., *City Surveyor's Office, Town Hall, Manchester.*

2377 1908. Jan. *LING, Richard Bertram, 53, *Dorothy Road, Lavender Hill, S.W.*

2378 1908. Jan. LOVETT, Robert W., M.D., 234, *Marlborough Street, Boston, U.S.A.*

2379 1908. Jan. *MOSS, Sidney Robert, 28, *Ashlin Grove, Lincoln.*

2380 1908. Jan. PEARSON, Albert E., M.R.C.S., L.R.C.P., *City Hospitals, Seacroft, Leeds.*

2381 1908. Jan. *PRITCHARD, Harold, 18, *Nicholas Street, Burnley.*

2382 1908. Jan. PORTER, Charles, M.D., B.SC., (*M.O.H.*), *The Town Hall, Rosebery Avenue, E.C.*

2383 1908. Jan. STAMP, Edward, *Florence House, Dewsnap Lane, Dukinfield, Cheshire.*

2384 1908. Jan. STEELE, David Wallace, *Science Teacher, The Mining and Technical College, Wigan, Lancs.*

2385 1908. Jan. ‡THOMPSON, Frederick William, P.A.S.I., *c o Mrs. Reynolds, Woodthorpe Road, Ashford, Middlesex.*

2386 1908. Jan. ‡TOWNSEND, Edward A., P.A.S.I., 131, *Wightman Road, Harringay, N.*

2387 1908. Jan.*‡M WILSON, Fred., 24, *Palace Gardens, Enfield.*

2388 1908. Jan. ZAHOR, Henry, M.D., *Health Officer of Prague, Bohemia.*

ASSOCIATES.

‡ Marked thus have passed the Examination for Inspectors of Nuisances.

S Marked thus have passed the Examination in Hygiene in its bearing on School Life.

Reg. No.	Date of Election	
4300	1908. Jan.	‡ABBOTT, Jerrold, *Town Hall, Ashbourne, Derby.*
4301	1908. Jan.	‡AGG, Alfred, 55, *St. James' Road, Forest Lane, Stratford.*
4302	1908. Jan.	‡ALLAM, Harry, 1, *Northwood Road, Forest Hill, S.E.*
4303	1908. Jan.	‡ALLIN, Albert Victor, 130, *Aldborough Road, Seven Kings.*

4303 1908. Jan. ‡Atkinson, Percy, *c/o Post Office, Preston, Ontario, Canada.*

4304 1908. Jan. ‡Barker, George S. E., *St. Moritz, Malden Hill, New Malden, Surrey.*

4305 1908. Jan. ‡Barker, James Alcock, 266, *Claughton Road, Birkenhead, Chester.*

4306 1908. Jan. ‡Barringer, George, 6, *Rosedale, Morrill Street, Hull.*

4307 1908. Jan. ‡Beken, Kenneth Stewart, *Blenheim House*, 24, *Elmwood Road, Herne Hill, S.E.*

4308 1908. Jan. ‡Biggs, William Harry, 233, *Brighton Road, South Croydon.*

4309 1908. Jan. ‡Brodrick, The Hon. Albinia, 50, *Hunter Street, W.C.*

4310 1908. Jan. ‡Broker, Arthur William, *Inspector and Surveyor, Wimblington, Cambs.*

4311 1908. Jan. ‡Brown, Alfred B., 12, *Woodlands Road, Cheetham Hill, Manchester.*

4312 1908. Jan. ‡Burr, Percy Beard Frank, 77, *Dale Street, Chiswick.*

4313 1908. Jan. ‡Caplen, Leonard, *Rusthall, Tunbridge Wells.*

4314 1908. Jan. ‡Casson, John, *Low Berks, Seathwaite, Broughton-in-Furness, Lancs.*

4315 1908. Jan. ‡Clay, Henry Hurrell, 12, *Bank Place, Bayswater, W.*

4316 1908. Jan. ‡Cossens, Miss Margery, 11, *Priory Street, Monmouth.*

4317 1908. Jan. *s* Crawford, Samuel Hugh, 8, *Baker Road, Harlesden, N.W.*

4318 1908. Jan. ‡Connolly, Miss Margaret, 3, *Peters Hill, Belfast.*

4319 1908. Jan. ‡Cooper, George James, 1, *Mabel House, Codington Hill, Honor Oak Park, S.E.*

4320 1908. Jan. ‡Darby, Frederick William, 3, *Skirbeck Road, Boston, Lincoln.*

4321 1908. Jan. *s* Davies, Miss Marian Gwyneth, *Dolanog, Pensarn, Avergele, N. Wales.*

4322 1908. Jan, ‡Deacon, Frederick James, *Woodside, Addlestone, Surrey.*

4323 1908. Jan. ‡Edser, William George, *Ivydene, Montpelier Road, Sutton, Surrey.*

4324 1908. Jan. ‡Evans, Miss Lillian, 45, *Saville Road, Blackpool.*

4325 1908. Jan. ‡Freeman, Ernest Charles, 30, *Essex Rd., Enfield, N.*

4326 1908. Jan. ‡Grant, Leonard B., *Urban District Council, Sittingbourne, Kent.*

4327 1908. Jan. ‡Goodwin, Frederick Edmund, 113a, *Henry Street, Chatham.*

1908. Jan. ‡GREEN, Henry Charles, 14, *Beecroft Road, Brockley, S.E.*

1908. Jan. ‡HAMBY, Charles Leopold, 68, *Park Road, Lowestoft.*

1908. Jan. ‡HANCOCK, Harry, *Glen Rise, Campbell Road, Twickenham.*

1908. Jan. ‡HILL, Edwin, 4, *Brookside Terrace, Colborne, Lancs.*

1908. Jan. ‡HITCHMOUGH, Alfred Hesketh, *Rose Cottage, Little Neston, Chester.*

1908. Jan. ‡HUGHES, William Owen, *Mount House, Ebenezer, Cwmgiglo R.S.O., Carnarvon.*

1908. Jan. ‡JACKSON, Hubert St. John, 133, *Waterloo Road, Wolverhampton.*

1908. Jan. ‡JENNER, Albert James, *Sanitary Department, Tonbridge U.D.C., Kent.*

1908. Jan. ‡JENNINGS, Charles Percival Barlow, 7, *Elliott Road, Thornton Heath, S.E.*

1908. Jan. ‡JONES, Gwilym Aneurin, *Penmaen, Glam.*

1908. Jan. ‡KINNISON, Mrs. Helen, 2, *Harewood Place, Hanover Square, W.*

1908. Jan. ‡LANGFORD, Francis Charles, 11, *South Vale, Upper Norwood, S.E.*

1908. Jan. ‡LEE, Miss Eliza, 20, *Kensington Terrace, Darlington.*

1908. Jan. ‡LEEKE, John, 11, *Natal Road, Mill Road, Cambridge.*

1908. Jan. ‡LOACH, Archibald Ernest, 14, *Goddington Road, Strood, Kent.*

1908. Jan. § McCLUSKIE, Miss Margaret, E., 2, *Hestercombe Avenue, Fulham, S.W.*

1908. Jan. ‡MAY, Philip George, 1, *Risinghoime Road, Wealdstone, Middlesex.*

1908. Jan. ‡MILNE, David Dawson, 69, *Regent Street, Keith, Banff.*

1908. Jan. ‡MONKHOUSE, Miss Mary, 45, *Stepney Green, E.*

1908. Jan. ‡MOORE, Edward George, 77, *Chaffinch Road, Beckenham, Kent.*

1908. Jan. ‡NAPIER, Henry Anderson, 13, *Brussels Road, St. John's Hill, New Wandsworth, S.W.*

1908. Jan. § NESBIT, Miss Anthonia Zara Nisbeth, 1, *St. Albans Villas, Highgate Road, N.*

1908. Jan. ‡OBORN, Alfred John, *Burry Port U.D.C., Carmarthen.*

1908. Jan. ‡OBORN, Stanley Mill, *Borough Surveyor's Office, Swansea.*

1908. Jan. ‡PHILLIPS, Henry Charles, *Borough Surveyor's Office, Town Hall, Basingstoke.*

1908. Jan. ‡Rampling, George Harry, 2, *Prince Street, Sudbury, Suffolk.*

1908. Jan. ‡Reynolds, Frederick, 22, *Albert Street, Regent's Park, N.W.*

1908. Jan. ‡Reynolds, Harold W., 1, *Bank Road, Crumpsall, Manchester.*

1908. Jan. ‡Robertson, Laurence, 33, *Commercial Street, Leith.*

1908. Jan. ‡Saunders, Richard, 65, *Pelham Road, Gravesend.*

1908. Jan. ‡Schofield, Frank, *Council Offices, Droylsden U.D.C., Lancs.*

1908. Jan. ‡Sharwood, Sydney Edward, *Inspector, Board of Health, Kimberley, S. Africa.*

1908. Jan. § Skinner, Arthur, 92, *Northumberland Park, Tottenham, N.*

1908. Jan. ‡Smith, William Edward, 43, *Milton Road, Herne Hill, S.E.*

1908. Jan. ‡Tattersall, Herbert, 562, *Holderness Road, Kingston-upon-Hull.*

1908. Jan. ‡Thomas, Arthur, 1, *Marlborough Road, Falmouth.*

1908. Jan. ‡Turner, Edward William, 13, *Yarra Road, Cleethorpes.*

1908. Jan. ‡Walker, Harry, 55, *Croydon Road, Plaistow, Essex.*

1908. Jan. ‡Wilshire, Arthur James, *Roseneath, Lancaster Road, New Barnet. Herts.*

1908. Jan. ‡Wood, William, 10, *Earleshall Road, Eltham, S.E.*

1908. Jan. ‡Yates, Miss Mona, 391, *Boeton Road, Irlams-o'-th'-Height, near Manchester.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY.*

*** *For Publications of Societies and Institutions, etc., see under "Academies."*

ACADEMIES (British).

London. *Institution of Civil Engineers.* Minutes of Proceedings, with other selected and abstracted papers. Volume CLXIX., 1906 7, Part III. 535 pp., 8vo. London, 1907. *The Institution.*

——— *The Surveyors' Institution.* Transactions. Volume XL., Part 1. 28 pp., 8vo. London, 1907. *The Institution.*

——— *Chemical Society.* List of the Officers and Fellows of the, corrected to August, 1907. 122 pp., 8vo. London, 1907. *The Society.*

——— *National League for Physical Education and Improvement.* Second Annual Report, 1907. 31 pp., 8vo. London, 1907. *The League.*

——— *City of London College.* Calendar for 1907-1908. 200 pp., 8vo. London, 1907. *The College.*

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* Members or Associates wishing to file or catalogue these Titles can, on application, be supplied with excerpt copies for this purpose.

Andrews, *F. W., M.D., D.P.H.* Lessons in Disinfection and Sterilisation. Second Edition. 222 pp., 8vo. London, 1907.
J. & A. Churchill (publishers).

Ball, *Charles B.*, and **Sherriff,** *H. T.* A Plumbing Catechism; or The Theory and Practice of Plumbing Design in Question and Answer. 100 pp., 8vo. Chicago, 1906. *"Domestic Engineering."*

Brown, *Sir Hanbury, K.C.M.G.* Irrigation: Its Principles and Practice as a branch of Engineering. 307 pp., 8vo. London, 1907.
A. Constable & Co. (publishers).

Calmette, *Dr. A.* Recherches sur l'Epuration Biologique et Chimique des Eaux d'Egout. Premier Volume. 192 pp, 8vo. Paris, 1905.

—— Recherches sur l'Epuration Biologique et Chimique des Eaux d'Egout. 316 pp., 8vo. Paris, 1907. *The Author.*

Clarke, *J. Wright.* Hydraulic Rams: their Principles and Construction. A handbook for practical men. 131 pp., 8vo. London, 07. *The Author.*

Coley-Bromfield, *J., C.E.* Smokeless Fuel. 17 pp., 8vo. London, 1891.
The Author.

Factory and Workshop Act, 1901. Preliminary Tables (subject to correction) of the Administration of Local Authorities in 1906 of the Homework Provisions. 15 pp., fcp. London, 1906. *Chief Inspector of Factories.*

Fletcher, *Professor Banister.* The London Building Acts, 1894, 1898, and 1905. Fourth Edition. Revised with further Notes and Cases, by Banister F. Fletcher, F.R.I.B.A., F.S.I., and H. Phillips Fletcher, F.R.I.B.A., F.S.I. 520 pp., 8vo. London, 1907. *B. T. Batsford (publisher).*

Fletcher, *Banister F.*, and **Fletcher,** *H. Phillips.* Architectural Hygiene. Third Edition. Revised. 272 pp., 8vo. London, 1907.
Whittaker & Co. (publishers).

Foster, *M., M.A., M.B., LL.D., F.R.S.* A Textbook of Physiology. Sixth Edition. Part I.—406 pp., 8vo. London and New York, 1893. Part II.—555 pp., 8vo. London and New York, 1899. Part IV.—339 pp., 8vo. London and New York, 1900.

Foster, *Sir Michael, K.C.B., M.D., F.R.S.*, and **Shore,** *Lewis E., M.D.* Physiology for Beginners. 266 pp., 8vo. London, 1907.
Macmillan & Co., Ltd. (publishers).

Hart, *G. A.*, The Relative Merits of Chemically-treated, Settled, and Septic Sewage in preparing the liquid for Oxidising Beds. Engineering Conference, 1907. 4 pp., 8vo. London, 1907. *The Author.*

EXHIBITION OF SCHOOL BUILDING AND FURNISHING APPLIANCES, LONDON, 1907.

ADDITIONAL AWARD FOR EXHIBIT SELECTED FOR FURTHER TRIAL.

BRONZE MEDAL.

OZONAIR, LTD.—Combined Ventilating and Ozonizing Appliances.

THE ROYAL SANITARY INSTITUTE.

REVIEWS OF BOOKS.

Hydraulic Rams.*

This is not only an instructive, but a very interesting little book. In these days, when machines, appliances, and devices are manufactured by those who are experts in their own wares, and can be ordered as required, professional men do not trouble themselves to design such things, nor are they expected to do so. Nevertheless, it is desirable that those who are responsible for special devices should know all about them, and the present little work affords an opportunity not often met in connection with such matters.

This is no manufacturer's advertisement wrapped in a palatable form, but a simple description of the principles, construction, and uses of hydraulic rams, with chapters on water collection, working capacity, repairs, etc, among which is interspersed much useful knowledge as to the details, and many useful hints tending to their perfection.

The book is written in a style to be expected of one whose time is often devoted to teaching, and is not only clear to the youthful mechanic, but is refreshing to those of greater attainments. W. C. T.

Waterworks Distribution.†

A thoroughly satisfactory book on the subject of waterworks, and of a convenient size.

It is by an engineer of long standing on the particular subject dealt with, and is therefore the outgrowth of practical experience.

The subject matter is dealt with in five chapters of 154 pages, comprising: General Arrangement of Supply; System of Distribution; Laying-out of Distributing Mains; Pipes and Fittings; and Measurement of Water and Regulating Supplies.

The illustrations and diagrams form one of its features, and on this score it ought to have a wide use and especially among those who are taking up the subject, as it forms a capital text-book for the use of students and candidates for practical sanitary science, or for municipal engineers or other examinations.

J. E. W.

A School for Mothers.‡

This little book, to which an introduction has been written by Sir Thomas Barlow, gives an account of an experiment at present being conducted in St. Pancras.

*Hydraulic Rams: their Principles and Construction. A Handbook for Practical Men, by J. Wright Clarke. 131 pp. London, 1907. Price 3s.

† Waterworks Distribution, by J. A. McPherson, M.Inst.C.E., Engineer, Bristol Waterworks. 161 pp. London, 1907. B. T. Batsford.

‡ A School for Mothers, by Evelyn M. Bunting, Dora E. L. Bunting, M.B., B.S., Annie E. Barnes, and Blanche Gardiner, B.A. 86 pages. London, 1908. Horace Marshall & Co. Price 1s.

The "Welcome Club," which has been founded by the St. Pancras Mothers and Infants Society, serves as a centre for various activities calculated to reduce infantile mortality. Of these an interesting and readable account is given by the writers.

Dr. Sykes, whose views on the importance of keeping breast-feeding in the forefront of all campaigns against infantile mortality are well known, describes the evolution of the scheme, and subsequent chapters deal in detail with the work carried on at this club. The two outstanding features are the infant consultations and the provision of cheap (not necessarily free) meals for expectant and nursing mothers.

Though closely co-ordinated with the public health department of the borough, the club is supported by voluntary subscriptions and not out of the rates. It should be noted, too, that the post of medical officer is an honorary one. With such arrangements no fault can be found while the work is in the experimental stage, but as progress is made it would seem only fair that the "municipal setting" should at least take the shape of a substantial contribution towards the expenses of administration. The Welcome Club is doing good work for the community, and we look forward to the day when similar provision will be made in the crowded areas of all our large towns.

We may add that the illustrations are not the least attractive part of the book. Some of the advertisements of proprietary foods might, however, have been omitted with advantage. H. M. R.

ARTICLES RELATING TO PUBLIC HEALTH,*

Appearing in the chief British and Foreign Journals and Transactions.

Abstracts of Titles classified in this List under the following headings:—

Science in Relation to Hygiene and Preventive Medicine.
Hygiene of Special Classes, Trades, and Professions; and Municipal Administration.
Building Materials, Construction, and Machinery.
Water Supply, Sewerage, and Refuse Disposal.
Heating, Lighting, and Ventilating.
Personal and Domestic Hygiene.

The articles referred to in this list are as far as possible collected and filed in the Library of the Institute for the use of the Members and Associates.

Hygiene of Special Classes, Trades, and Professions; and Municipal Administration.

CALDER, W., Assoc.M.Inst.C.E. Municipal matters in Great Britain and America and on the Continent. *Surveyor*, Sept. 27th, p. 341–2; Oct. 4th, p. 362–3; Oct. 11th, p. 387–8; Oct. 18th, p. 404–5; and Oct. 25th, 1907, Supplement.

Refuse disposal—collection and cartage of refuse—road pavements—the dust

* Members or Associates wishing to file or catalogue these Titles can, on application, be supplied with excerpt copies for this purpose.

problem—street sweeping, watering, and lighting—parks and playgrounds—gardens—baths and washhouses—sewage disposal—city improvements—civic centres—smoke abatement.

HALDANE, Dr. J. S. The Hygiene of Work in Compressed Air. *Journ. Soc. Arts*, Vol. lvi., No. 2879, p. 213–226 (1908).

Nature of the work (diving, caisson work, tunnelling)—difficulties and dangers of the work (ear, respiratory, caisson disease)—the last treated in detail, with tables and diagrams.

Building Materials, Construction and Machinery.

"ENGINEERING RECORD." Preservation of Steel Reinforcement in Concrete Structures. Jan. 25th, 1908, p. 105.

Description of the pulling down of a reinforced concrete building, where the steel had been protected by the cement, although subjected to tidal action.

Water Supply, Sewerage, and Refuse Disposal.

ASHE, W. W. Relation of Soils and Forest Cover to Quality and Quantity of Surface Water in the Potomac Basin. U.S. Geol. Survey: Water-supply Paper 192 (1907), p. 299–335.

Effect of soils on turbidity of water—effect of forest cover on stream flow—turbidity in reservoirs.

DEVONSHIRE, EASTON, Assoc.M.Inst.C.E. Notes on the Water Supply of Paris and Suburbs. *Surveyor*, Dec. 27th, 1907, p. 656–7.

The Paris water undertaking—method of laying mains—armoured concrete pipes—present situation of water supply of Paris.

"ENGINEERING RECORD." The Final Decision regarding the Septic Tank Patents. Jan. 25th, 1908, p. 99.

The Decision of the U.S. Circuit Court of Appeals, in "Cameron Septic Tank Co. v. Village of Saratoga Springs."—opinion written by Judge Lacombe.

——— Tuberculation and the Flow of Water in Pipes. Jan. 25th, 1908, p. 106.

Description of the formation and mode of removal of nodules and incrustations in iron water pipes.

——— Street Cleansing in Denver, Col. Dec. 7th, 1907, p. 637.

Streets consist of 25 miles paved with asphalte, 35 miles with sandstone block, and 12 miles macadam. Rotary sweeping machines collect the detritus in furrows, automatic machines then follow and pick it up, and when the weather is suitable sanitary flush-tank wagons wash the asphalte.

HUNTER, C. F., Stud.Inst.C.E. The Drainage of a Detached House. . . *Surveyor*, Sept. 27th, 1907, p. 339–40.

Foul-water drainage—surface drainage—ventilation—interceptors—testing.

JENNINGS, WALTER. Wash-down Closets. *Building News*, Nov. 29th, 1907, p. 735–6.

Syphonic discharge—compared with wash-down closets—joints between metal and stoneware pipes—varieties of wash-down closets—efficient working—traps and their working—ventilation.

PARKER, H. N. Stream Pollution, occurrence of Typhoid Fever, and Character of Surface Waters in Potomac Basin. U.S. Geol. Survey: Water-supply Paper 192 (1907), p. 190, pls. viii., ix.

Stream pollution—general aspects—industries discharging wastes into the streams (tanning, manufacture of wood pulp, of illuminating gas, of ammonia, wool scouring, dyeing, manufacture of whiskey)—pollution by districts—population and drainage area—occurrence of typhoid fever—quality of surface waters—plate ix.: relation of stream flow to cases of typhoid.

PORT OF LONDON: A Series of Expert Studies and Reports. Large 8vo. London. 1907.

Pollution, pp. 33–38—effect of sea-water on sewage, pp. 67–70—the sanitary condition of the river, by W. J. Dibdin, pp. 114–120.

WILLIAMSON, ANDREW, C.E. Sand Filtration of Water Supplies. *Engineering*, Nov. 1st, 1907, p. 577–78, and Nov. 22nd, p. 708–9.

Importance of filtration—connection between purity of supply and epidemics—epidemics in Hamburg and Lincoln—death-rates from filtered and unfiltered waters—construction of filters.

The working of filters—methods of cleansing the filtering medium—biological action of sand filters—experiments at Lawrence, Mass., as to bacteria passing through filters—rate of filtration.

Personal and Domestic Hygiene.

QUÉRÉE, H. C. Disinfecting Stations and Appliances. *Surveyor*, Oct. 11th, 1907, p. 380–2.

Station to be isolated—disinfection by hot air—by steam—description of an apparatus on high-pressure steam principle—ditto, low-pressure.

MEETINGS HELD.

SESSIONAL MEETINGS.

London.—The meeting was held in the Parkes Museum on February 12th, when a discussion on "Rivers Pollution, with reference to the Board proposed by The Royal Commission," was introduced by Sir William Ramsay, K.C.B., LL.D., D.Sc., F.R.S. The chair was taken by Sir Alexander R. Binnie, M.Inst.C.E. (Vice-President).

Nottingham, February 14th.—The members were welcomed by the Mayor (Councillor J. T. Spalding), and the discussion on "Present-day Road Requirements in Town and Country" was opened by A. Brown.

M.Inst.C.E., the City Engineer, and E. Purnell Hooley, M.Inst.C.E., County Surveyor. In the afternoon a visit was arranged to the Works and Ways Depot, where a Demonstration of Road-making was given, and inspections of various types of Road-paving on the City and County were made.

CARDIFF CONGRESS.

A Public Meeting was held in Cardiff on February 6th, 1908, when The Right Hon. Lord Mayor presided. It was announced that the Right Hon. The Earl of Plymouth, C.B., P.C., D.L., J.P., has accepted the Presidentship of the Congress. Mr. J. Allcock, City Treasurer, was elected Treasurer of the Congress, and Dr. E. Walford, Medical Officer of Health, and Dr. W. Williams, County Medical Officer of Health, Hon. Local Secretaries.

The following Sections and Conferences have been arranged :—

Section I.—Sanitary Science and Preventive Medicine.
President :—

Section II.—Engineering and Architecture.
President :—Sir HENRY TANNER, I.S.O., F.R.I.B.A.

Conferences.

Municipal Representatives—
President :—Councillor J. ROBINSON, L.R.C.P., Chairman, Health and Port Sanitary Committee, Cardiff.

Port Sanitary Authorities—
President :—

Medical Officers of Health—
President :—E. WALFORD, M.D., D.P.H., Medical Officer of Health, Cardiff.

Engineers and Surveyors to County and other Sanitary Authorities—
President :—A. E. COLLINS, M.Inst.C.E., City Engineer, Norwich.

Veterinary Inspectors—
President :—Prof. J. PENBERTHY, F.R.C.V.S.

Sanitary Inspectors—
President :—G. H. ANDERSON, Chairman, Central Executive Council, Sanitary Inspectors' Association.

Women on Hygiene—
President :—

Hygiene of School Life—
President :—E. H. GRIFFITHS, D.Sc., F.R.S., Principal, University College of South Wales and Monmouth.

The Exhibition will be open from July 13th to 22nd. With this number of the Journal is enclosed a Member's application form for Tickets for the Meetings.

The Committee will be glad to receive any offers of papers for the Congress from Members; those wishing to contribute should send in their names as early as possible to the Secretary.

Arrangements have been made with the various railway companies to issue return tickets to Cardiff at a single fare and a quarter from July 9th to 27th.

Examinations.

The following Examinations have been held :—

Sanitary Science as applied to Buildings and Public Works.

Perth, W. Australia, Dec. 6 & 7, 1907 7 candidates: 6 certificates granted.
Hull, Feb. 21 and 22, 1908 ..... 3 candidates: 1 certificate granted.

Examination Qualifying for Membership.

Hull, Feb. 21 and 22, 1908 ..... 1 candidate: 1 certificate granted.

Inspectors of Nuisances.

Perth, W. Australia, Dec. 6 & 7, 1907 19 candidates: 12 certificates granted.
Hull, Feb. 21 and 22, 1908..... 16 candidates; 9 certificates granted.

Inspectors of Meat and other Foods.

Perth, W. Australia, Dec. 9 & 10, 1907 9 candidates; 7 certificates granted.
Glasgow, Feb. 7 and 8, 1908 ..... 1 candidate; no certificate granted.

Candidates who have received Certificates.

Sanitary Science as applied to Buildings and Public Works.

Dodds, Joseph Taylor.
Don, Robert.
Downie, Arthur Thomas.
Hague, Harold Wilfrid.
McKeown, James Woodburn.
Purdie, Charles McMillan.
Trott, John Daniel.

Examination Qualifying for Membership.

Cass, Thomas Foley.

Inspectors of Nuisances.

Begley, Cornelius.
Chambers, Henry Ernest.
Chapman, Herbert John.
Charles, Albert George.
Don, Robert.
Easton, Frank Gill.
Elliott, John William.
Hancock, George Adam.
Huck, Joseph Henry.
Lee, George Alfred.
Lenihan, Harriet.
Lyne, Lionel George.
Miller, Jane Harriet.
Miller, Joseph Bass.
Morris, George Stephen.
Shaw, George Atha.
Smith, Thomas John.
Swinbourn, James Henshaw.
Tatham, Joseph.
Teasmer, Ernest.
Walden, William Henry Waterman.

Inspectors of Meat and other Foods.

Chambers, Henry Ernest.
Hague, Harold Wilfrid.
Higgs, Franklan.
James, Thomas Annandale.
Maller, Frederick Thomas.
Pethebick, Hugh Wright.
Riley, John.

FORTHCOMING MEETINGS.

Lecture to the Institute.

"The Results of Sanitation in the Efficiency of Armies in Peace and War," by Surgeon-General Sir Alfred Keogh, K.C.B., M.D., LL.D., Director-General, Army Medical Service. The date cannot be definitely arranged at present.

Sessional Meetings.

Blackpool, March 13th, at 7.30 p.m. Discussion on "Sewer Ventilation and the Intercepting Trap," to be opened by F. J. H. Coutts, M.D., B.Sc., D.P.H., F.C.S., Medical Officer of Health for the County Borough, and J. S. Brodie, M.Inst.C.E., Engineer and Surveyor for the County Borough.

On Saturday, March 14th, visits will be made to the Destructor and Electricity Works, Infectious Disease Hospital, etc.

Hull, Saturday, April 4th, at 11 a.m. Discussion on "Diphtheria in Elementary Schools and its Prevention," opened by J. Wright Mason, M.D., C.M., D.P.H., Medical Officer of Health, Hull. Visits will be made to the Docks and Cold Storage.

Annual Meeting of Associates.

London, Tuesday, March 24th. In the Parkes Museum, at 8 p.m. Address by H. Percy Boulnois, M.Inst.C.E., on "House Refuse, Collection and Disposal."

Lectures.

Special Course on Food and Meat Inspection.

Seventh Special Course for Commissioned Officers and Professional Men preparing for the Examination for Inspection of Meat and other Foods, conducted by The Royal Sanitary Institute, will commence on April 27th.

Courses of Lectures are now in progress for—

Sanitary Officers.
Hygiene in its bearing on School Life.
Practical Training for Meat Inspectors.
Sanitary Science as applied to Buildings and Public Works.

Examinations.

In Sanitary Science as applied to Buildings and Public Works, for Inspectors Qualifying for Membership, for Inspectors of Nuisances, in Hygiene in its Bearing on School Life—

Blackburn, Feb. 28th and 29th. | *Southampton*, April 3rd and 4th.
Hereford, March 20th and 21st. | *Ipswich*, April 10th and 11th.
Liverpool, April 24th and 25th.

Inspectors of Meat and other Foods—

Hull, March 6th and 7th.

The dates and subjects of the Lectures and Demonstrations in each Course are given month by month in the Calendar.

Calendar, March and April, 1908.

As far as at present arranged.

Council and Committee Meetings are suspended during August and September, and the Museum and Library are closed on Public Holidays.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

MARCH.

2 M. Lecture to Sanitary Officers at 7 p.m. "Infectious Diseases," by Prof. A. Bostock Hill, M.D., M.SC., M.O.H. Warwickshire C. C.

3 T. Lecture to Sanitary Officers at 7 p.m. "Methods of Disinfection," by Prof. A. Bostock Hill. M.D., M.SC.

4 W. Inspection and Visit to Common Lodging House, Kemble Street, Drury Lane, W.C., at 2.30 p.m.; and at 4 p.m. Inspection of Messrs. Callard, Stewart, and Watt's Bakery, Little Dean Street, Soho, W.

4 W. Lecture to Sanitary Officers at 7 p.m. "Elementary Statistics," by Prof. A. Bostock Hill, M.B., M.SC.

5 Th. Lecture to School Teachers at 7 p.m. "Physiology," by Prof. H. R. Kenwood. M.B., D.P.H.

5 Th. Demonstration of Book-keeping as carried out in a Sanitary Inspector's Office, at the Public Health Office, Town Hall, Upper Street, Islington, N., at 7 p.m., by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

5 Th. Lecture—Meat Inspectors' Course at 6.30 p.m.

6 F. Lecture to School Teachers, at 7 p.m. "Physiology," by Prof. H. R. Kenwood, M.B., D.P.H.

6 F. Lecture to Sanitary Officers at 7 p.m. "Elementary Science: Physics, Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

6 F. } 7 S. } Examination for Inspectors of Meat and Other Foods, Hull.

9 M. Demonstration on Building Materials and Construction, in the Parkes Museum at 6 p.m., by the Director, E. White Wallis, F.S.S.

9 M. Lecture to School Teachers at 7 p.m. "Physiology," by Prof. H. R. Kenwood, M.B., D.P.H.

10 T. Lecture to Sanitary Officers at 7 p.m. "Elementary Science: Physics, Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

11 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

13 F. Demonstration on Meteorological Instruments in the Parkes Museum at 6 p.m. by the Director, E. White Wallis, F.S.S.

13 F. Lecture to School Teachers at 7 p.m. "Food and Clothing," by Col. J. Lane Notter, M.A., M.D., R.A.M.C.

13 F. Lecture to Sanitary Officers at 7 p.m. "Elementary Science: Physics, Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

13. F. } 14. S. } **Sessional Meeting**, Blackpool at 7.30 p.m. Discussion on "Sewer Ventilation and the Intercepting Trap," to be opened by Francis J. H. Coutts, M.D., B.SC., D.P.H., F.C.S., Medical Officer of Health for the County Borough, and J. S. Brodie, M.INST.C.E., Engineer and Surveyor for the County Borough. On Saturday, March 14th, visits will be made to the Destructor and Electricity Works, and the Infectious Diseases Hospital, etc.

14 S. Inspection and Demonstration at the Battersea Disinfecting Station, Mortuary, and Shelter, at 2.15 p.m. Conducted by G. Quin. Lennane, F.R.C.S., L.R.C.P., D.P.H., M.O.H., Battersea.

14 S. Demonstration—Meat Inspectors' Course, at 2 p.m.

16 M. Demonstration in the Parkes Museum, at 6 p.m. Baths and Lavatories, by the Director, E. White Wallis, F.S.S.

16 M. Lecture to School Teachers, at 7 p.m., "School Buildings, Water Supply, etc.," by J. Osborne Smith, F.R.I.B.A.

16 M. Lecture to Sanitary Officers at 7 p.m., "Elementary Science: Physics, Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

17 T. Lecture to Sanitary Officers at 7 p.m., "Elementary Science: Physics, Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

18 W. Inspection and Demonstration at the East London Soap Works, Bow, at 3 p.m. Arranged by Messrs. E. Cook & Co., Ltd.

18 W. Demonstration in the Parkes Museum, at 6 p.m. Waste Preventers and Water Closets, by the Director, E. White Wallis, F.S.S.

18 W. Lecture to Sanitary Officers at 7 p.m. "Calculations, Measurements, and Plans and Sections," by W. C. Tyndale, M.INST.C.E.

19 Th. Lecture to School Teachers at 7 p.m. "School Furniture," by Prof. H. R. Kenwood, M.B., D.P.H.

20 F. Lecture—Meat Inspectors' Course, at 6.30 p.m.

20 F. Lecture to Sanitary Officers at 7 p.m. "Building Materials," by H. D. Searles Wood, F.R.I.B.A.

20 F.
21 S. } Examinations—Hereford.

21 S. Inspection and Demonstration at the Sewage and Destructor Works, Ealing, at 2.15 p.m. Conducted by Charles Jones, M.INST.C.E., Borough Engineer and Surveyor.

21 S. Demonstration at a School on the General Planning of Schools and their Sanitary Arrangements and Fittings, by J. Osborne Smith, F.R.I.B.A.

23 M. Demonstration in the Parkes Museum, at 6 p.m., Pipe Joints and Drain Testing Appliances, by the Director, E. White Wallis, F.S.S.

23 M. Lecture to Sanitary Officers at 7 p.m. "Sanitary Building Construction," by H. D. Searles Wood, F.R.I.B.A.

23 M. Lecture to School Teachers at 7 p.m. "Physical Exercises," by P. Boobbyer, M.D.

24 T. **Annual Meeting of Associates** at 8 p.m. Address by H. Percy Boulnois, M.INST.C.E., on "House Refuse, Collection and Disposal."

25 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

25 W. Demonstration in the Parkes Museum, at 6 p.m., on House Drainage, by the Director, E. White Wallis, F.S.S.

25 W. Lecture—Sanitary Science Course, at 7 p.m. "Sanitary Building Construction" (Advanced), by H. D. Searles Wood, F.R.I.B.A.

27 F. Demonstration in the Parkes Museum, at 6 p.m., on Water Supply by the Director, E. White Wallis, F.S.S.

27 F. Lecture to Sanitary Officers at 7 p.m. "Sanitary Appliances," by W. C. Tyndale, M.INST.C.E.

28 S. Demonstration—Meat Inspectors' Course, at 2 p.m.

28 S. Inspection and Demonstration at the Sewage Works, Sutton, Surrey, at 3 p.m. Conducted by C. Chambers Smith, Town Surveyor.

30 M. Lecture to Sanitary Officers at 7 p.m. "Ventilation," by J. Osborne Smith, F.R.I.B.A.

APRIL.

1 W. Inspection and Demonstration at the East London Waterworks, Lea Bridge, Clapton, at 3 p.m. Conducted by Mr. Blackburn, Deputy Engineer.

1 W. Lecture to Sanitary Officers at 7 p.m. "Details of Plumbers' Work," by J. Wright Clarke.

3 F. Lecture—Meat Inspectors' Course at 6.30 p.m.
3 F. Lecture to Sanitary Officers at 7 p.m. "House Drainage," by W. C. Tyndale, M.INST.C.E.
3 F. } Examinations—Southampton.
4 S. }
4 S. **Sessional Meeting,** HULL, at 11 a.m. Discussion on "Diphtheria in Elementary Schools and its Prevention," opened by J. Wright Mason, M.D., C.M., D.P.H. Visits will be made to the Docks and Cold Storage.
15 W. **Ordinary General Meeting,** at 4.30 p.m.

MAY.

12 T. **Annual Dinner of the Institute,** at the Langham Hotel, The President, His Grace the Duke of Northumberland, K.G., in the chair.

JULY.

13–22. **Congress and Exhibition, Cardiff.**

LIST OF FELLOWS, MEMBERS, AND ASSOCIATES ELECTED,

FEBRUARY, 1908.

Reg. No.	Date of Election.	FELLOW.
[illegible]	1908. Feb.	ELLIS, Inspector-General Sir Herbert M., K.C.B., K.H.P., F.R.C.S., LL.D., R.N., *Medical Dept., Admiralty, 18, Victoria Street, S.W.*

MEMBERS.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.

* Marked thus have passed the Examination in Sanitary Science as applied to Buildings and Public Works.

[illegible]	1908. Feb.	ALDRIDGE, Arthur Edwin William, *Borough Surveyor's Department, Walsall.*
[illegible]	1908. Feb.	ARDERN, Edward, M.SC.VICT., *Resident Chemist, Manchester Corporation Sewage Works, Greengates, Davyhulme, Urmston, Lancs.*
[illegible]	1908. Feb.	‡HAILSTONE, Thomas Henry, *Borough Engineer and Surveyor, 1, Castle Hill, Richmond, Yorks.*
[illegible]	1908. Feb.	HAWKE, Willie Clifford, ASSOC.M.INST.C.E., *Borough Engineer, Maison Dieu House, Dover.*
[illegible]	1908. Feb.	HILL-WILLIS, Stephen Alexander, A.M.I.MECH.E., *Engineer and Surveyor, 2, Orsett Road, Grays, Essex.*
[illegible]	1908. Feb.	KELLY, Sydney Appleton, F.A.S.I., 175, *Walton Village, Liverpool.*
[illegible]	1908. Feb.	KING, Gilbert Rigley, 30, *Seymour Gardens, Twickenham S.W.*

Reg. No. Date of Election.

2400 1908. Feb. LANG, Albert Lancelot, M.S.A., *Architect to Education Committee*, 3, *Avenue Rd., Spring Grove, Isleworth.*

2401 1908. Feb. LUKE, John, P.A.S.I., 53, *Sparkenhoe Street, Leicester.*

2402 1908. Feb. MANSFIELD, Frank, *City Surveyor's Department, Town Hall, Hereford.*

2403 1908. Feb. NEWELL, Alfred George, M.B., C.M., M.D., L.M., D.P.H., *Kurseong, Bengal, India.*

2404 1908. Feb. PRIESTLEY, Charles Henry, M.INST.C.E., *Waterworks Engineer, City Hall, Cardiff.*

2405 1908. Feb. STROUD, Ernest Lionel, F.R.C.V.S., 29, *Spring Street, Hyde Park, W.*

2406 1908. Feb. WOOD, Thomas, M.D., J.P., *Eastwood*, 182, *Ferry Road, Bonnington, Edinburgh.*

2407 1908. Feb. YOUNG, George, B.A., B.SC., A.M.I.E.E., *Osborne House, Havelock Street, Sheffield.*

2408 1908. Feb. *WINTERBOTTOM, Roland Hare, *Neston Villas, Littleborough, Lancaster.*

ASSOCIATES.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.

4372 1908. Feb. ‡ANDERSON, Miss Mabel, *Chute House, New Milton, Hants.*

4369 1908. Feb. BARR, Alfred, 2, *Charleston Street, Walworth, S.E.*

4373 1908. Feb. ‡BENTLEY, Richard Francis, 63, *Dalberg Road, Brixton, S.E.*

4391 1896. May. ‡BOURNE, Edward, 3, *Crescent Terrace, Cheltenham.*

4374 1908. Feb. ‡BURDEN, Frederick George Sydney. 22, *St. Kilda Road, West Ealing, W.*

4375 1908. Feb. ‡BURGESS, George Edward, 301, *Oldham Road, Manchester.*

4376 1908. Feb. ‡CHATTERJIE, Noel Clement, *Pallavram, Madras, India.*

4377 1908. Feb. ‡CLARKE, Ernest, 55, *Grey Rock Street, Liverpool.*

4378 1908. Feb. ‡COLE, Alfred, 16, *Braydon Road, Stamford Hill, N.*

4379 1908. Feb. ‡COSTON, Miss Mary Wall, 20, *Camden Hill Road, Upper Norwood, S.E.*

4380 1908. Feb. ‡FOSTER, Thomas, *Milburn, Newbiggin, Carlisle.*

4381 1908. Feb. ‡McEWEN, Robert Gardiner, *Sanitary Inspector, City of Victoria, Hong Kong, China.*

4382 1901. Mar. ‡MANSFIELD, W. T., *c/o James Spicer & Sons, Grey Street, Wellington, New Zealand.*

4382 1908. Feb. ‡NAYLOR. George William, *Lyndhurst, Barnoldswick, York.*

4383 1908. Feb. ‡PIKE, George Wilfred, *Lyndhurst, Bedworth, Warwick.*

Reg. No.	Date of Election.	
[illegible]	1908. Feb.	‡PRICE, Robert Lewis, *Surveyor and Sanitary Inspector, Dawley, Salop.*
[illegible]	1908. Feb.	‡PRIEST, William Arthur, 58, *Three Shires Oak Road, Bearwood, Birmingham.*
[illegible]	1908. Feb.	‡RANSOM, Miss D. M., 195, *Edgware Road, W.*
[illegible]	1908. Feb.	‡REVELL, Wilfred George, 39, *Ganna Park Road, Plymouth.*
[illegible]	1908. Feb.	SANDIFORD, Herbert, *Ivy Villa, Cheam, Sutton, Surrey.*
[illegible]	1908. Feb.	‡SLATER, Percy Henry, 37, *Albion Street, Exmouth, Devon.*
[illegible]	1908. Feb.	‡STEPHENS, Miss Nora St., 2, *Garlinge Road, West Hampstead, N.W.*
[illegible]	1908. Feb.	STEVENS, Charles, *Inspector of Nuisances and Building Surveyor, Wychbold, Droitwich, Worcester.*
[illegible]	1908. Feb.	‡WATERHOUSE, Arthur Albert, 117, *Trentham Street, Southfields, Wandsworth, S.W.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY*

*** *For publications of Societies and Institutions, etc., see under "Academies."*

ACADEMIES (BRITISH).

London. *Association of Water Engineers.* Transactions, Vol. XI., 1906, with subject Index, Vols. I. to XI. 350 pp., 8vo. London and New York, 1907. *The Association.*

——— *Royal Institution of Great Britain.* Proceedings, Vol. XVIII., Part II. 253 pp., 8vo. London, 1907. *The Institution.*

— *Surveyors' Institution.* Transactions, Session 1907—1908. Vol. XL., Parts II. and III. 75 pp., 8vo. London, 1907. *The Institution.*

Army Medical Department. Report for the Year 1906. 318 pp., 8vo. London, 1907. *The Director-General.*

Ball, *Charles B.* The Relation of the Inspector of Plumbing to other City Officials. 8 pp., 8vo. Chicago, 1907.

— The Trap on the Main Drain. 10 pp., 8vo. Chicago, 1907. *Domestic Engineering.*

Belfast, County Borough of. Report of Councillors Henry O'Neill, M.D., and Wm. M'Clure, the Delegates appointed by the Public Health Committee to the Second International Congress on School Hygiene in London. London, August, 1907. 23 pp., 8vo. Belfast, 1907. *The Public Health Committee.*

Berne. Résultats du recensement fédéral des entreprises agricoles, industrielles et commerciales du 9 aout 1905. 404 pp., 4to. Berne, 1907. *Bureau de Statistique.*

Board of Agriculture and Fisheries. Agricultural Statistics, 1906. Vol. XLI., Part IV. Colonial and Foreign Statistics, with Index to Vol. XLI. 107 pp., 8vo. London, 1907. *The Board.*

* Members or Associates wishing to file or catalogue these Titles can, on application, be supplied with excerpt copies for this purpose.

Catalonia. *Primer Congrés d'Higiène.* Llibre d'Actes. 169 pp., 4to. Catalonia. *P. Garcia Faria.*

Dublin. *Department of Agriculture and Technical Instruction for Ireland.* Report of the Director of the Institution of Science and Art for the Year 1906–7. 31 pp., 8vo. Dublin, 1907. *G. T. Plunkett, Director.*

Hazer, Allen. Clean Water and How to get it. 188 pp., 8vo. London and New York, 1907. *Chapman & Hall, Ltd. (publishers).*

Hoff, *Dr. E. M.* Aarsberetning Angaaende Sendhedstilstanden I Kobentava fur 1906. 70 pp., 8vo. Copenhagen, 1907. *Dr. E. M. Hoff.*

Huddersfield. Infantile Mortality. The Working of the Huddersfield Scheme. 12 pp., 8vo. Huddersfield, 1907. *S. G. Moore, M.D., D.P.H.*

Jones. *Herbert, D.P.H.* School Hygiene: a Handbook for School Teachers of all grades, School Managers, etc. 161 pp., 8vo. London, 1907. *The Author.*

Kanthack, *Emilia.* The Preservation of Infant Life: a Guide for Health Visitors. 92 pp., 8vo. London, 1907. *H. K. Lewis (publisher).*

Local Government Board. Dr. W. W. E. Fletcher's Report upon the Sanitary Circumstances of Heacham and certain other coast villages on the Northern and Western Littoral of the Docking Rural District. No. 294. 11 pp., fcp. London, 1907.

——— Dr. E. P. Manby's Report upon the Sanitary Circumstances and Administration of the Four Sanitary Districts comprised within the Staines Registration District. No. 292. 19 pp., fcp. London, 1907.

——— Dr. J. Spencer Low's Report on the Sanitary Circumstances and Administration of the Hawarden Rural District. No. 295. 13 pp., fcp. London, 1907.

——— Dr. Reginald Farrar's Report on Accommodation provided for Strawberry Pickers in the Dartford Rural District. No. 293. 5 pp., fcp. London, 1907.

——— Dr. W. W. E. Fletcher's Report upon the Sanitary Circumstances and Administration of the Aberayron Registration District, comprising the Rural District of Aberayron and the Urban Districts of Aberayron and New Quay in Cardiganshire. No. 283. 20 pp., fcp. London, 1907.

——— Dr. E. P. Manley's Report upon the Sanitary Circumstances and Administration of the Rural District of Tregaron in the County of Cardigan. No. 284. 6 pp., fcp. London, 1907.

——— Dr. R. W. Johnstone's Report upon the Sanitary Circumstances and Administration of the Rural District of Sherborne (Dorset). No. 285. 6 pp., fcp. London, 1907.

——— Dr. F. St. George Mivart's Report on the Sanitary Circumstances and Administration of the Thingoe Rural District. No. 286. 14 pp., fcp. London, 1907.

——— Dr. Reginald Farrar's Report on the Sanitary Circumstances and Administration of the Urban District of Whitby. No. 287. 15 pp., fcp. London, 1907.

——— Dr. J. Spencer Low's Report upon the Sanitary Circumstances and Administration of the Hartley Wintney Rural District. No. 288. 16 pp., fcp. London, 1907.

——— Dr. F. St. George Mivart's Report on the General Sanitary Circumstances and Administration of the Bourne Urban District. No. 289. 8 pp., fcp. London, 1907.

——— Dr. R. J. Reece's Report on the prevalence of Diphtheria at the village of Ringmer, in the Chailey Rural District of Sussex. No. 290. 9 pp., fcp. London, 1907.

Local Government Board. Dr. S. W. Wheaton's Report on the Sanitary Circumstances and Administration of the Winchcomb Rural District, and on the prevalence of Diphtheria at Winchcomb. No. 291. 10 pp., fcp. London, 1907. *W. H. Power, C.B., F.R.S.*

London County Council. Report of the Public Health Committee, submitting the Report of the Medical Officer of Health of the County for the Year 1906. 184 pp., fcp. London, 1907. *Sir Shirley Murphy.*

McVail, *J. C., M.D., D.P.H., F.R.S.E.* The Prevention of Infectious Diseases: being the Lane Lectures delivered at Cooper Medical College, San Francisco, in August, 1906, and revised for publication. 305 pp., 8vo. London, 1907. *The Author.*

Massachusetts. Thirty-eighth Annual Report of the State Board of Health. 750 pp., 8vo. Boston, 1907. *The Board.*

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Aberdeen, 1906, and Oct. & Nov., 1907 *Matthew Hay, M.D.*

Capetown, Year ended 30th June, 1907 .. .. *A. S. Arenhold, M.D.*

Chicago, 1906 .. .. .. *Charles J. Whalen, M.D.*

Huddersfield, 3rd Quarter .. .. *S. G. Moore, M.D., D.P.H.*

Kimberley (Sanitary Inspector's Report), 1906 .. .. .. *James S. Dunn, A.R.San.I.*

Lancaster, 1906 .. .. .. *E. Sergeant, L.R.C.P., M.R.C.S.*

London County Council. Report of the Education Committee, submitting the Report of the Medical Officer (Education) for the year ended 31st March, 1907 .. .. *James Kerr, M.A., M.D., D.P.H.*

Montreal, 1906 .. .. .. *Louis Laberge, M.D.*

Staffordshire C.C., 1906 .. .. *George Reid, M.D., D.P.H.*

Tasmania, 1906–1907 .. .. *J. S. C. Elkington, M.D., D.P.H.*

Wandsworth, Year ended 31st March, 1907 .. .. *Henry G. Hills, Town Clerk.*

Warwickshire C.C., 1906 .. .. *A. Bostock Hill, M.Sc., M.D., D.P.H.*

Michigan. Thirty-fourth Annual Report of the Secretary of the State Board of Health, for the fiscal year ending June 30th, 1906. 176 pp., 8vo. Lansing, Michigan, 1907. *The Board.*

Mothers, a School for. By Evelyn M. Bunting, Dorah E. L. Bunting, M.B., B.S., Annie E. Barnes, and Blanche Gardiner, B.A.; with an Introduction by Sir Thomas Barlow, Bart., and a Chapter by Dr. J. F. J. Sykes. 86 pp., 8vo. London, 1907. *Annie E. Barnes, Lady Superintendent.*

New Jersey State Board of Health. Public Health Laws. 155 pp., 8vo. New Jersey, 1907. *The State Board of Health.*

New South Wales, 1906. Report of the Board of Health on Plague. On a Sixth Outbreak of Plague at Sydney, 1906, by J. Ashburton Thompson, M.D., D.P.H. 12 pp., fcp. Sydney, 1907. *J. Ashburton Thompson, M.D., D.P.H.*

Newstead. *Robert, A.L.S., F.E.S.* Preliminary Report on the Habits, Life-Cycle, and Breeding Places of the Common House-Fly (*Musca Domestica*. Lin.), as observed in the City of Liverpool, with suggestions as to the best means of checking its increase. December, 1906, to October, 1907, 30 pp., 8vo. Liverpool, 1907. *Town Clerk, Liverpool.*

Paris. Notes a l'appui du compte des dépenses de l'Exercise, 1906. 250 pp., 4to. Paris, 1907. *Directeur Administratif des Travaux de Paris.*

Pearce, *T. Frederick, M.D., D.P.H., F.R.C.S., M.R.C.P.* Insects and Disease. Reprinted from the *Calcutta Medical Journal*. Volume I. (No. XII., June, 1907). 21 pp., 8vo. Calcutta, 1907. *The Author.*

Queensland. Report on Plague, from 26th February, 1900, to 30th June, 1907. 166 pp., fcp. Brisbane, 1907. *B. Burnett Ham, Commissioner of Public Health.*

Sacadura, *Dr. Da Costa.* L'Hygiène Scolaire en Portugal. 44 pp., 8vo. Lisbon, 1907.

——— Quelques considérations sur les dimensions de la tete du foetus à terme. 16 pp., 8vo. Lisbon, 1906.

——— Attitudes Viciosas Las Escolas. (Escripta directa e escripta inclinada). 40 pp., 8vo. Lisbon, 1906. *The Author.*

Sanitary Record. Year Book and Diary, 1908. 67 pp., 4to. London, 1907. *The Sanitary Publishing Co.*

Schrotter. *Prof. Dr. Leopold von.* Hygiene of the Lung in Health and Disease. Translated by H. W. Armit, M.R.C.S., L.R.C.P. 150 pp. 8vo. London and New York, 1907. *Rebman, Ltd. (publishers).*

Scoble, *H. T., F.R.Met.Soc., M.R.San.I.* Land Treatment of Sewage: A Digest of the Reports made to the Royal Commission on Sewage Disposal by their specially appointed Officers. Reprinted from *The Surveyor and Municipal and County Engineer*. 76 pp., 4to. London, 1907. *The Author.*

Tibbles. *W., LL.D.* Food and Hygiene: an Elementary Treatise upon Dietetics and Hygiene Treatment. 683 pp., 8vo. London, 1907. *Rebman, Ltd.*

Vienna. Vierteljahrsfehrift für körperliche Erziehung. 61 pp. 4to. Vienna, 1907. *W. Whitaker, B.A., F.R.S.*

West Riding Rivers Board. Report upon Methods of Analysis adopted in the Laboratory. 20 pp., 8vo. Wakefield, 1907. *H. Maclean Wilson, M.D., B.Sc.*

Wilson. *H. Maclean, M.D., B.Sc.* Report upon a Visit to Germany in connection with the Fourteenth International Congress of Hygiene, September, 1907. 11 pp., 8vo. Wakefield, 1907. *The Author.*

In addition to the Books presented to the Library, the following have been published in connection with Sanitary Science:—

Buchanan, *A.,* and **Hudson,** *W. H.* Building Construction. Class Note-Books with Diagrams. London, 1908. W. H. Hudson.

Crowe, *H. Warren, M.D.* Consumption: Treatment at Home and Rules for Living. Bristol, 1907. John Wright & Co.

Daniels, *G. W., M.B.Cantab.,* and **Stanton,** *A. T., M.D.* Studies in Laboratory Work. London: John Bale, Sons, & Danielsson, Ltd.

Ferguson. *R. Bruce, M.A., M.D., B.C.* Aids to the Mathematics of Hygiene. Bailliere, Tindall, & Cox.

Gerhard, *William Paul.* Sanitation of Public Buildings. London: Chapman & Hall.

Graham. *John W., M.A.* The Destruction of Daylight: A Study in the Smoke Problem. George Allen.

Housden, *C. E.* Practical Hydraulics (Water Supply and Drainage). London, 1908. Longmans, Green, & Co.

Pattin, *H. Cooper, M.A., D.P.H.* The Ritual of Temperance and Bodily Cleanliness. London, 1908. Simpkin, Marshall, & Co.

Slocum, *S. E., B.E., Ph.D.*, and **Hancock**, *E. L., M.S.* Text-book on the Strength of Materials. London, 1908. Ginn & Co.

Stuart, *Hackworth.* Medical Inspection of School Children. London, 1908. H. K. Lewis.

Todd, *Ernest.* The Law of Buildings and Dilapidations. London: Eyre & Spottiswoode.

Trewby, *A., M.A.* Healthy Boyhood. London, 1908. The Author.

Unwin, *W.C., LL.D., F.R.S.* A Treatise of Hydraulics. London, 1908. Adam & Charles Black.

Zavitzianos, *Dr. S. K.* The Hygiene of Armies. Corfu: A. Lantza.

LIST OF EXHIBITS ADDED TO THE MUSEUM.

Asphalte. Mineral lithofalt asphalte grooved paving blocks for stables, roadways, etc. *The Limmer Asphalte Paving Co., Ltd., 2, Moorgate Street, E.C.*

Reinforced Concrete. Metal ladder tape for thin partitions, produced by splitting strips of steel at intervals. It is supplied in coils, and can with ease be expanded to a ladder-like form by means of a simple appliance. To form a partition, lengths are secured vertically and other lengths drawn through them horizontally, so as to form a ladder.

Pryke & Palmer, 40, Upper Thames Street, E.C.

Bed and Foot Warmer. A copper cylinder for hot water revolving on a wooden handle, so that it can be rolled about the bed.

F. F. Wallis, Finsbury Square, E.C.

Dental Charts. Illustrating various imperfections and diseases of teeth, and giving directions as to care, etc. *W. Fish, School Dentists' Society, Watford.*

Defective Drain. Root of a tree taken from an open-jointed rain-water drain.

B. A. Knappett, Catford, S.E.

Lavatory Fittings. Mirror in white glazed earthenware frame.

Letter Box. White glazed earthenware brick prepared for letter-box opening.

The Leeds Fireclay Co., Ltd., 2, Norfolk Street, Strand, W.

Milk Strainer and Filter. The "Ulax" pattern, a large tin funnel ending in a short cylinder just above which is a ledge supporting two metal gauze discs. Between these is placed the filtering medium of prepared cotton which is rather larger than the discs, so as to completely cover the opening at the bottom of the funnel. *L. Lumley & Co., Ltd., 1, America Square, E.C.*

EXHIBITION OF SCHOOL BUILDING AND FURNISHING APPLIANCES, LONDON, 1907.

ADDITIONAL AWARD FOR EXHIBIT SELECTED FOR FURTHER TRIAL.

BRONZE MEDAL.

THE PLASTOMENT ASBESTOS FLOORING CO. Plastoment Flooring.

THE ROYAL SANITARY INSTITUTE.

ARTICLES RELATING TO PUBLIC HEALTH,*

Appearing in the chief British and Foreign Journals and Transactions.

Abstracts of Titles classified in this List under the following headings:—

Science in Relation to Hygiene and Preventive Medicine.
Hygiene of Special Classes, Trades, and Professions; and Municipal Administration.
Building Materials, Construction, and Machinery.
Water Supply, Sewerage, and Refuse Disposal.
Heating, Lighting, and Ventilating.
Personal and Domestic Hygiene.

The articles referred to in this list are as far as possible collected and filed in the Library of the Institute for the use of the Members and Associates.

Hygiene of Special Classes, Trades, and Professions; and Municipal Administration.

Douglas, L. M. Modern Dairy Practice. *Journ. Royal Soc. Arts*, Vol. LVI., No. 2885, pp. 398-409, 1908.

General. Advocating hygienic conditions. With discussion.

Oliver, Dr. T. Lead and Phosphorus Poisoning, with special reference to the manufacture of lucifer matches. *Journ. Royal Soc. Arts*, Vol. LVI., No. 2882, pp 311-17, 1908.

Notes. Hard life of lead miners; but risk of lead-poisoning begins with smelting. Describes manufacture of white lead and its dangers. Alludes to red lead. Describes the symptoms of plumbism. Then under following headings:—Substitutes for white lead. Preventive measures. Phosphorus and lucifer match manufactures.

Water Supply, Sewerage, and Refuse Disposal.

Burgess, P. The Development of the Mechanical Filter Plant. *Engineering Record.*

Description of mechanical filtration up to a modern plant comprising (1) A coagulant and a system for its application to the water to be treated; (2) Storage of the water after the coagulant has been introduced and before it is applied to the filters; (3) Filters; (4) Storage of the water between the filters and the high service pumps.

"Engineering Record." Street Cleaning and Waste Disposal in New York. 22nd Feb., 1908, p. 207.

Report by a Commission upon the street cleaning and waste disposal in New York, with suggestions for their improvement.

——— Water Purification in Ohio. 22nd Feb., 1908, p. 213.

Result of five years' study by the Ohio State Board of Health of the sanitary conditions of Ohio streams.

* Members or Associates wishing to file or catalogue these Titles can, on application, be supplied with excerpt copies for this purpose.

MEETINGS HELD.

Sessional Meeting.

Blackpool, March 13th.—The meeting was held in the Council Chamber, when a discussion on "Sewer Ventilation and the Intercepting Trap" was opened by F. J. H. Coutts, M.D., B.Sc., D.P.H., F.C.S., Medical Officer of Health, and J. S. Brodie, M.Inst.C.E., Borough Engineer and Surveyor. On Saturday, March 14th, visits were made to the Destructor and Electricity Works, the Infectious Diseases Hospital, etc., where the members were entertained at Tea by the Hospitals Committee.

Annual Meeting of Associates.

London.—The meeting was held in the Parkes Museum, on Tuesday, March 24th, at 8 p.m., when an address was delivered by H. Percy Boulnois, M.Inst.C.E., on "House Refuse, Collection and Disposal."

Examinations.

The following Examinations have been held:—

Sanitary Science as applied to Buildings and Public Works.

Blackburn, Feb. 28th and 29th ..... 1 candidate: no certificate granted.
Hereford, March 20th and 21st ..... 1 candidate: 1 certificate granted.

Examination Qualifying for Membership.

Blackburn, Feb. 28th and 29th ..... 1 candidate: no certificate granted.

Inspectors of Nuisances.

Blackburn, Feb. 28th and 29th .....22 candidates: 12 certificates granted.
Hereford, March 20th and 21st .....14 candidates; 5 certificates granted.

Inspectors of Meat and other Foods.

Hull, March 6th and 7th .....14 candidates; 8 certificates granted.

Hygiene in its bearing on School Life.

Blackburn, Feb. 28th and 29th ..... 9 candidates: 5 certificates granted.

Candidates who have received Certificates.

Sanitary Science as applied to Buildings and Public Works.

Ricketts, Frank.

Inspectors of Nuisances.

Bevan, Walter William.
Clarke, Charles.
Gash, William Lindsey.
Howells, Basil Philip.
Hudson, Fred.
Hudson, William Arthur.
Hunt, Martha Alice.
Jackson, Percy.
Jump, Frances Martha.
Lawson, George William.
Lynam, William Thomas.
Lyon, William Ernest.
Norris, William Astley.
Radford, Lilian.
Schofield, Fred.
Smith, George.
Wilson, Marion Campbell.

Inspectors of Meat and other Foods.

BROUGHTON, RICHARD.
CLAYTON, CHARLES PERCIVAL GLANVILLE.
HANCOCK, THOMAS.
HOLLAND, ALBERT.
JACKSON, JOHN HORSLEY.
MONSON, HAROLD RUDOLPH.
SCORRER, EDMUND HOLDRIDGE.
TATTERSALL, HERBERT.

Hygiene in its bearing on School Life.

DUERDEN, ETHEL.
HEARLE, EDITH M.
LUND, MARTHA.
NORRIS, DAISY FLORA.
RAMSDEN, AMY.

FORTHCOMING MEETINGS.

LECTURE TO THE INSTITUTE.

On "The Results of Sanitation in the Efficiency of Armies in Peace and War," by Surgeon-General Sir Alfred Keogh, K.C.B., M.D., LL.D., Director-General, Army Medical Service, has been postponed until October.

SESSIONAL MEETINGS.

Hull, April 4th, at 11 a.m. Discussion on "Diphtheria in Elementary Schools and its Prevention," opened by J. Wright Mason, M.D., C.M., D.P.H., Medical Officer of Health, Hull. Visits will be made to the Docks and Cold Storage.

London, April 8th, at 8 p.m. Adjourned discussion on "Rivers Pollution, with special reference to the Board proposed by the Royal Commission." Paper by Herbert T. Scoble, P.A.S.I.

Shrewsbury, May 23rd. Discussion on "The Inspection of Dairies and Cowsheds," to be opened by T. W. H. Garstang, M.A., D.P.H., Medical Officer of Health, Altrincham.

London, June 13th, 11 a.m. Discussion on "Pasteurization of Milk," to be opened by Prof. Henry R. Kenwood, M.B., D.P.H., Medical Officer of Health, Stoke Newington. In the afternoon a visit will be made to Sudbury Park Dairy Farm and the Walker Gordon Laboratories, by invitation of Mr. G. Titus Barham.

ORDINARY GENERAL MEETINGS.

The Ordinary General Meeting will be held in the Parkes Museum on Wednesday, April 15th, at 4.30 p.m.

ANNUAL DINNER.

His Grace the Duke of Northumberland, K.G., President of the Institute, has consented to take the chair at the Annual Dinner of the Institute, which will be held on Tuesday, May 12th, at the Langham Hotel.

EXAMINATIONS.

In Sanitary Science as applied to Buildings and Public Works, for Inspectors qualifying for membership, in Hygiene in its bearing on School Life and for Inspectors of Nuisances.

Southampton, April 3rd and 4th.
Ipswich, April 10th and 11th.
Liverpool, April 24th and 25th.
Edinburgh, May 8th and 9th.
Leeds, May 15th and 16th.
London, May 22nd and 23rd.

For Inspectors of Meat and other Foods—
Liverpool, May 1st and 2nd.
London, May 29th and 30th.

CONGRESS, 1908.

The Meeting will be held in Cardiff from July 13th to 18th, and the preliminary arrangements are as follows :—

President of the Congress –
THE RT. HON. THE EARL OF PLYMOUTH, P.C., C.B., D.L., J.P.,
Lord-Lieutenant of Glamorganshire.

Vice-Presidents—
THE RT. HON. THE LORD MAYOR OF CARDIFF (Councillor ILLTYD THOMAS, J.P.)
THE MOST NOBLE THE MARQUIS OF BUTE.
THE RT. HON. VISCOUNT TREDEGAR, D.L., J.P., *Lord-Lieutenant of Monmouth.*
THE RT. HON. EARL OF DUNRAVEN, K.P., C.M.G., P.C.
THE RT. HON. LORD ABERDARE, D.L., *President, University of Wales.*
THE RT. REV. THE LORD BISHOP OF LLANDAFF (REV. J. P. HUGHES, D.D.)
SIR CLIFFORD J. CORY, Bart., J.P., M.P.
SIR WILLIAM THOMAS LEWIS, Bart., D.L., J.P.
SIR JOHN TALBOT DILLWYN LLEWELYN, Bart., D.L., J.P.
SIR JOHN WILLIAMS, Bart., K.C.V.O., M.D.
SIR WILLIAM S. CROSSMAN, Kt., J.P., *Ex-Lord Mayor of Cardiff.*
SIR JOHN GUNN, Kt., J.P.
THE HON. IVOR C. GUEST, M.P.
ROBERT FORREST, J.P.
JOHN CORY, J.P.
OLIVER HENRY JONES, J.P.

Chairman of Local Committee
Councillor JAMES ROBINSON, L.R.C.P., *Chairman of the Health and Port Sanitary Committee, Cardiff.*

Vice-Chairmen of Local Committee—
Councillor R. J. SMITH, M.B.; J. HOWARD JONES, M.B., D.P.H.; Councillor P. J. O'DONNELL; Col. HENRY LEWIS, J.P.; Principal E. H. GRIFFITHS, M.A., Sc.D., F.R.S.; T. F. HARVEY; R. H. WYRILL, M.Inst.C.E.

Honorary Local Treasurer—
J. Allcock, F.I.A.A., *City Treasurer, Cardiff.*

Honorary Local Secretaries—
E. Walford, M.D., D.P.H., *Medical Officer of Health, Cardiff.*
W. Williams, M.A., M.D., D.P.H., *Medical Officer of Health, Glamorganshire C.C.*

Section I. Sanitary Science and Preventive Medicine—
President—
Hon. Local Secretaries—F. W. Lamb, M.D., D.P.H.; J. Howard-Jones, M.D., D.Sc.
Recording Secretary—Prof. H. R. Kenwood, M.B., D.P.H.

„ II. Engineering and Architecture—
President—Sir Henry Tanner, I.S.O., F.R.I.B.A.
Hon. Local Secretaries—E. H. Bruton; C. H. Priestley, M.Inst.C.E.
Recording Secretary—J. E. Worth, M.Inst.C.E.

Conferences.

Municipal Representatives—
President—Councillor J. Robinson, L.R.C.P., *Chairman of the Health and Port Sanitary Committee, Cardiff.*
Hon. Local Secretaries—Councillor P. J. O'Donnell;
Recording Secretary—P. Boobbyer, M.D.

Port Sanitary Authorities—
President—Councillor John Utting, M.R.C.P., M.R.C.S., *Chairman, Port Sanitary Authority, Liverpool.*
Hon. Local Secretaries—G. Neale, L.R.C.P., J.P.; T. Anstey-Chave, M.B.
Recording Secretary—H. Williams, M.D., D.P.H.

Medical Officers of Health—
President—E. Walford, M.D., D.P.H., *Medical Officer of Health, Cardiff.*
Hon. Local Secretaries—Herbert Jones, L.R.C.S.I., D.P.H.; R. Prichard, M.D., D.P.H.
Recording Secretary—A. Wellesley Harris, M.R.C.S., D.P.H.

Engineers and Surveyors to Municipal Authorities—
President—A. E. Collins, M.Inst.C.E., *City Engineer, Norwich.*
Hon. Local Secretaries—R. H. Haynes, M.Inst.C.E.;
Recording Secretary—E. G. Mawbey, M.Inst.C.E.

Veterinary Inspectors—
President—Prof. J. Penberthy, F.R.C.V.S.
Hon. Local Secretaries—P. J. Mullane, M.R.C.V.S.;
Recording Secretary—J. A. Dixon, M.R.C.V.S.

Sanitary Inspectors—
President—G. H. Anderson, *Chairman, Central Executive Council, Sanitary Inspectors Association.*
Hon. Local Secretaries—D. T. Williams; G. Thomas.
Recording Secretary—Isaac Young.

Women on Hygiene—
President—The Lady Mayoress of Cardiff.
Hon. Local Secretaries—Miss E. A. Montgomery Wilson; Miss M. E. Pearson.
Recording Secretary—Miss E. P. Hughes.

The Hygiene of School Life

President—E. H. Griffiths, M.A., Sc.D., F.R.S., *Principal, University College of South Wales and Mon.*

Hon. Local Secretaries—Miss E. G. Hagerty; E. C. Willmott.

Recording Secretary—Miss A. Ravenhill.

Lecture to the Congress,

Popular Lecture,

by Prof. E. J. McWeeney, M.A., M.D., D.P.H.

Calendar, April and May, 1908.

As far as at present arranged.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

APRIL.

1 W. Inspection and Demonstration at the East London Waterworks, Lea Bridge, Clapton, at 3 p.m. Conducted by Mr. Blackburn, Deputy Engineer.

1 W. Lecture to Sanitary Officers at 7 p.m. "Details of Plumbers' Work," by J. Wright Clarke.

3 F. Lecture—Meat Inspectors' Course at 6.30 p.m.

3 F. Lecture to Sanitary Officers at 7 p.m. "House Drainage," by W. C. Tyndale, M.INST.C.E.

3 F. } Examinations—Southampton.
4 S. }

4 S. **Sessional Meeting**, Hull, at 11 a.m. Discussion on "Diphtheria in Elementary Schools and its Prevention," opened by J. Wright Mason, M.D., C.M., D.P.H. Visits will be made to the Docks and Cold Storage.

4 S. Inspection and Demonstration at Morden Hall Dairy Farm, Morden, Surrey, at 3 p.m. Conducted by Oscar J. White.

6 M. Lecture to School Teachers at 7 p.m. "Physical Conditions," by James Kerr, M.D.

6 M. Lecture to Sanitary Officers at 7 p.m. "Water: Composition, Pollution, and Purification," by A. Wellesley Harris, M.R.C.S., D.P.H.

7 T. Demonstration—Meat Inspectors' Course, at 6.30 p.m., on Foods, other than Meat, by Col. J. Lane Notter, R.A.M.C.

7 T. Lecture to Sanitary Officers at 7 p.m. "Water Supply," by J. E. Worth, M.INST.C.E.

8 W. Inspection and Demonstration in the District of Chiswick, at 3 p.m. (number limited). Conducted by J. H. Clarke, Chief Sanitary Inspector, Chiswick.

10 F. Lecture to Sanitary Officers at 7 p.m. "Sewerage," by J. E. Worth, M.INST.C.E.

10 F. } Examinations—Ipswich.
11 S. }

11 S. Inspection and Demonstration at the Sewage Outfall Works, Barking, at about 3 p.m. Conducted by J. E. Worth, M.INST.C.E., District Engineer, London County Council.

11 S. Demonstration—Meat Inspectors' Course, at 2 p.m.

13 M. Lecture to School Teachers at 7 p.m. "Physical Conditions," by J. Kerr, M.D.

13 M. Lecture to Sanitary Officers at 7 p.m. "Sewage Disposal," by J. E. Worth, M.INST.C.E.

14 T. Demonstration—Meat Inspectors' Course, at 6.30 p.m., on Foods, other than Meat, by Col. J. Lane Notter, R.A.M.C.

15 W. **Ordinary General Meeting**, at 4.30 p.m.

15 W. Lecture to Sanitary Officers at 7 p.m. "Scavenging: Disposal of House Refuse," by J. E. Worth, M.INST.C.E.
17 F. **Good Friday** } Museum Closed.
20 M. **Easter Monday** }
24 F. Lecture Meat Inspectors' Course at 6.30 p.m.
24 F. } Examinations—Liverpool.
25 S. }
27 M. Lecture to Sanitary Officers at 7 p.m. "Signs of Health and Disease in Animals destined for Food, when alive and after slaughter; Tuberculin and other Tests," by Major J. A. Meredith, F.R.C.V.S.
28 T. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., on Meat Inspection, by James King, M.R.C.V.S.
28 T. Lecture to Sanitary Officers at 7 p.m. "The Names and Situations of the Organs of the Body in Animals," by Major J. A. Meredith, F.R.C.V.S.
29 W. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., on Meat Inspection, by James King, M.R.C.V.S.
29 W. Lecture to Sanitary Officers at 7 p.m. "Practical Methods of Stalling and Slaughtering Animals," by Major J. A. Meredith, F.R.C.V.S.
30 Th. Inspection and Demonstration at the Metropolitan Cattle Market, York Road, N., at 2 p.m. Conducted by James King, M.R.C.V.S.

MAY.

1 F. Lecture—Meat Inspectors' Course, at 5.30 p.m.
1 F. Lecture to Sanitary Officers at 7 p.m. "The Appearance and Character of Flesh Meat, Organs, Fat, Blood, Fish, Poultry, Milk, Fruit, Vegetables, and other food, and the conditions rendering them, or preparations of them, fit or unfit for human consumption. Preserving and Storing Meat and other foods." by E. Petronell Manby, B.A., M.D., D.P.H., Medical Inspector, L.G.B.
1 F. } Examination for Inspectors of Meat and Other Foods, Liverpool.
2 S. }
2 S. Demonstration to Commissioned Officers and Professional Men at 3 p.m.
4 M. Lecture to Sanitary Officers at 7 p.m. "The Hygiene of Byres, Lairs, Cowsheds, and Slaughterhouses, and all places where animals destined for the supply of food are kept, and the Hygiene of Markets, Dairies, and other places where food is stored, prepared, or exposed for sale, and transported," by E. Petronell Manby, B.A., M.D., D.P.H., Medical Inspector, L.G.B.
5 T. Inspection and Demonstration in Fish Inspection at Billingsgate Market at 10 a.m., conducted by J. Roberts, Chief Fish Inspector, Fishmongers' Company.
5 T. Lecture to Commissioned Officers and Professional Men at 5.30 p.m. on Meat Inspection, by James King, M.R.C.V.S.
6 W. Inspection and Demonstration at Harrison & Barber's Knackers' Yard, Winthrop Street, Whitechapel, E., at 3 p.m. Conducted by R. Glover, F.R.C.V.S.
6 W. Lecture to Sanitary Officers at 7 p.m. Diseased Meat, with a Demonstration of Morbid Specimens collected from Meat Markets, by James King, M.R.C.V.S.
8 F. Lecture—Meat Inspectors' Course, at 6.30 p.m.
8 F. Lecture to Sanitary Officers at 7 p.m. The Laws, By-laws, and Regulations affecting the inspection and sale of Meat and other articles of Food, including their preparation and adulteration, by E. Petronell Manby, B.A., M.D., D.P.H., Medical Inspector, L.G.B.
8 F. } Examinations—Edinburgh.
9 S. }
23 S. **Sessional Meeting,** SHREWSBURY, at 11 a.m. Discussion on "Inspection of Dairies and Cowsheds," opened by T. W. H. Garstang, M.A., D.P.H., Medical Officer of Health, Altrincham.

JUNE.

13 S. **Sessional Meeting,** LONDON, at 11 a.m. Discussion on "Pasteurization of Milk," to be opened by Prof. R. H. Kenwood, M.B., D.P.H., Medical Officer of Health, Stoke Newington. In the afternoon a visit will be made to the Sudbury Park Dairy Farm and the Walker Gordon Laboratories by invitation of Mr. G. Titus Barham.

JULY.

13-22. **Congress and Exhibition, Cardiff.**

LIST OF FELLOWS, MEMBERS, AND ASSOCIATES

ELECTED MARCH, 1908.

Reg. No. | Date of Election.

FELLOW.

2127 1908. Feb. KEOGH, Surgeon-General Sir Alfred, K.C.B., K.H.P., HON.LL.D., M.D., R.A.M.C., *Director-General, Army Medical Service, War Office, S.W.*

MEMBERS.

* Marked thus have passed the Examination of the Institute in Sanitary Science as applied to Buildings and Public Works

‡ Marked thus have passed the Examination for Inspectors of Nuisances.

§ Marked thus have passed the Examination in Practical Hygiene for School Teachers.

☛ Marked thus have passed the Examination Qualifying for Membership.

*☛ 1908. Mar. ‡ANDERSON, George Hart, *Sanitary Dept., Municipal Buildings, Middlesbrough.*

*☛ 1908. Mar. BETTS, William Vallance, 630, *Radford Road, Nottingham.*

2111 1908. Mar. BOOTH, Ernest Wilton, ASSOC.M.INST.C.E., P.A.S.I., *Borough Engineer's Office, Croydon.*

*☛ 1908. Mar. BROMLEY, Albert Nelson, F.R.I.B.A., *Queen Street Nottingham.*

*☛ 1908. Mar. BROWN, Arthur Goodwin, *Burton Buildings, Upper Parliament Street, Nottingham.*

2111 1908. Mar. CHIPMAN, Willis, B.A.SC., M.CAN.SOC.C.E., 103, *Bay Street, Toronto.*

*☛ 1908. Mar. COLLINS, Arthur Elliston, M.INST.C.E., *City Engineer, Guildhall, Norwich.*

*☛ 1908. Mar. CORFIELD, Frederick John Arthur, 119, *Victoria Street, Westminster, S.W.*

*☛ 1908. Mar. DAVIS, Edwin Francis, *Assistant Engineer, Durban Corporation, Borough Engineer's Office, Durban, Natal.*

2111 1908. Mar. DOUGLAS, Alexander J., M.D., C.M., *(M.O.H.), City Hall, Winnipeg, Canada.*

*☛ 1908. Mar. EVANS, Thomas John, *County Surveyor's Office, Trowbridge ("Ferndeigh," Clarendon Road, Trowbridge.)*

*☛ 1908. Mar. GALBRAITH, Ernest Scott, L.R.C.P. & S. EDIN., L.F.P.S.G., D.P.H.LOND., 74, *Hartland Road, West Ham, E.*

*☛ 1908. Mar. GIBSON, James Albert, M.D., C.M., D.P.H., *(M.O.H.), The Shrubbery, Newport, I. of W.*

*☛ 1908. Mar. GORDON, Thomas Wallis, A.R.I.B.A., *Deputy City Engineer, The Guildhall, Nottingham.*

4125 1908. Mar. HAWORTH, Frederic George, M.B., C.M.GLAS., L.R.C.S.E., D.P.H.CAMB., *(M.O.H.), Vale House, Darwen, Lancs.*

1908. Mar. HEWITT, Harry Edward, M.D., B.S.LOND., D.P.H. CAMB., 5, *York Mansions, Prince of Wales Road, S.W.*

1908. Mar. LANDON, Ernest Edward, M.R.C.S., L.R.C.P., D.P.H. DUB., *Bradbourne House, Acton, W.*

1908. Mar. MOHUN, Edward, M.CAN.SOC.C.E., M.AM.SOC.C.E., *Victoria, British Columbia.*

1908. Mar. SANJANA, K. S., B.SC., L.C.E.BOMBAY, 16, *Trebovir Road, Earl's Court, S.W.*

1908. Mar. *‡CASS, T. Foley, *Town Hall, Kingston-upon-Hull.*

1908. Mar. *DODDS, Joseph Taylor, 17, *Park Street, Hull.*

ASSOCIATES.

‡ Marked thus have passed the Examination for Inspectors of Nuisances.

1908. Mar. GOSFORTH, the Urban District Council of, *Council Chambers, Gosforth, Northumberland.*

1908. Mar. ‡BANNINGTON, Bertram George, 12, *Charston Avenue, Upton Park, E.*

4095 1908. Mar. ‡CHAPMAN, Herbert John, *Rose Cottage, St. Philip's Road, Newmarket.*

4103 1908. Mar. ‡EDWARDS, Arthur J., 59, *The Drive, Loughton.*

4096 1908. Mar. ‡GALE, Henry, 33, *Sussex Road, Devonport.*

1908. Mar. ‡HANCOCK, George Adam, 127, *Alliance Avenue, Anlaby Road, Hull.*

4098 1908. Mar. ‡JONES, Miss Nellie F., *Lasswade, Westwood Park, Forest Hill, S.E.*

4104 1908. Mar. ‡PALMER, J. B., 74, *Cedar Road, Southampton.*

4099 1908. Mar. ‡SEAMAN, William John, 47, *West Pottergate Street, Norwich.*

4100 1908. Mar. ‡THOMAS, Llewellin James, 68, *Oakfield Road, Clifton, Bristol.*

4105 1904. Dec. ‡WALKER, Charles, *Sanitary Inspector's Office, North Parade, Otley, Yorks.*

4101 1908. Mar. ‡WATERHOUSE, Arthur Albert, 117, *Trentham St., Southfields, S.W.*

4102 1908. Mar. ‡WINN, William Warren, 144, *Park Road, Crouch End, N.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY.*

*** For publications of Societies and Institutions, etc., see under "Academies."*

Alexander, *F. W., L.R.C.P., M.R.C.S., D.P.H.* Electrolytically-produced Fluids containing Hypochlorites, their Manufacture, and the Rationale and Chemistry of the process for securing stability. Reprinted from the *Lancet*, Jan. 18th, 1908. 8 pp., 8vo. London, 1908. *The Author.*

Berna. Risultati del censimento federale delle aziende agricole, industrialli e commerciali del 9 Agosto 1905. 142 pp., 4to. Berna, 1907.
Le Dipartimento dell' Interno.

Birmingham, *C. L., M.D., D.P.H.* Sanatoria and the Auxiliaries of Sanatorium Treatment. Statement presented to a Conference of Delegates from each of the Counties in the Province of Connaught, which met at Athlone on the 28th January, 1908, for the purpose of discussing the best means available for the Prevention of Consumption. 12 pp., 8vo. Westport, 1908.
The Author.

Board of Agriculture and Fisheries. Agricultural Statistics, 1907, Vol XLII., Part I. Acreage and Live Stock Returns of Great Britain, with Summaries for the United Kingdom. 93 pp., 8vo. London, 1907. *The Board.*

Board of Education. Report for the Year 1906–1907. 120 pp., 8vo. London, 1907.

——— Japanese Educational Exhibition. Notes on the Organisation of Japanese Education. 20 pp., 8vo. London, 1907. *The Board of Education.*

Burgerstein, *Dr. Leo.* Schulhygiene. 138 pp., 8vo. Leipzig, 1906. *The Author.*

Calcutta. Report on Plague for year ending 30th June, 1907, by T. Frederick Pearse, M.D., F.R.S., M.R.C.S., D.P.H., Special Health Officer. Edited by W. C. Hossack, M.D., with Appendices by W. C. Hossack, M.D., and H. M. Crake, M.B., C.M. 65 pp., fcap. Calcutta, 1907. *The Editor.*

Calmette, *Dr. A.* Recherches sur l'Epuration biologique et chimique des Eaux d'Egout. Troisième Volume. 279 pp., 8vo. Paris, 1908. *The Author.*

Courmelles, *Dr. Foveau de.* L'Année Electrique, Electrothérapique, et Radiographique. Revue Annuelle des Progrès Electriques en 1907. Huitième Année. 368 pp., 8vo. Paris, 1908. *The Author.*

Dunfermline. Second Annual Report on the Medical Inspection of School Children, 1907. 30 pp., 8vo. Dunfermline, 1907.
J. C. Bridge, M.R.C.S., L.R.C.P., D.P.H.

Eder, *M. D., B.Sc.* Disease in the Schoolroom. 16 pp., 8vo. London, 1907.
The Author.

Goat, The case for, with the practical experience of twenty-four experts, by "Home Counties." 172 pp., 8vo. London, 1908.
George Routledge & Sons, Ltd. (publishers).

Hossack, *W. C., M.D.* Further Experiments as to the Potency of various Disinfectants against Pulex Cheopis. Reprinted from the *Indian Medical Gazette*, Vol. XLII., No. 10, October, 1907. 9 pp., 8vo. Calcutta, 1907.

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* Members or Associates wishing to file or catalogue these Titles can, on application be supplied with excerpt copies for this purpose.

Hossack, *W. C., M.D.* Aids to the Identification of Rats connected with Plague in India, with Suggestions as to the Collection of Specimens. Second Edition. Published by the Trustees of the Indian Museum. 15 pp., 8vo. Allahabad, 1907.

——— Memoirs of the Indian Museum. Vol. I., No. 1: An Account of the Rats of Calcutta (Text and Plates). 88 pp., 4to. Calcutta, 1907. *The Author.*

Hoylake and West Kirby Urban District Council. Meteorological Report and Results of Observations for the year 1907, by T. Robinson, M.R.San.I. 12 pp., 16mo. Hoylake, 1908. *The Author.*

King Edward VII. Sanatorium, *Midhurst.* Annual Report, July, 1906, to July, 1907. 36 pp., 8vo. Midhurst, 1908.
C. Theodore Williams, M.D., F.R.C.P.

Kirchner, *Dr. Martin.* Die gesetzlichen Grundlagen der Seuchenbekampfung im Deutschen Reiche unter besonderer Berucksichtigung Preubens. 345 pp., 8vo. Jena, 1907.

——— Hygiene und Seuchenbekampfung: Gesammelte Abhandlungen. 664 pp., 8vo. Berlin, 1904. *The Author.*

Local Government Board. Thirty-fifth Annual Report, 1905–1906. Supplement in continuation of the Report of the Medical Officer for 1905–1906 on Sanatoria for Consumption, and certain other aspects of the Tuberculosis Question. 682 pp., 8vo. London, 1908.

——— Dr. R. W. Johnstone's Report upon the Sanitary Circumstances and Administration of the Rural District of Dorchester. No. 296. 6 pp., fcp. London, 1908.

——— Dr. G. S. Buchanan's Report on certain imported Meat Foods of questionable wholesomeness. 17 pp., fcp. London, 1908.
W. H. Power, C.B., F.R.S.

——— Dr. A. W. J. MacFadden's report on inquiries with regard to the wholesomeness of Tripe of Home and Foreign Origin. No. 4. 12 pp., fcap. London, 1908.

——— Dr. J. M. Hamill's report on the preparation and sale of Vinegar, in relation to the administration of the Sale of Food and Drugs Acts. No. 5. 28 pp., fcap. London, 1908.

——— Dr. Reginald Farrar's report on the sanitary circumstances and administration of the Emley, Farnley Tyas, Gunthwaite-and-Ingbirchworth, Hoylandswaine, and Thurstonland Urban Districts, in the West Riding of Yorkshire, together with suggestions for the formation of Joint Sanitary Districts. No. 297. 25 pp., fcap. London, 1908.

——— Dr. R. Deane Sweeting's report on a recent Epidemic of Scarlatina in the Urban District of Burnham-on-Crouch (Essex), and on the Measures taken with respect thereto. 5 pp., fcp. London, 1908.

——— Dr. S. Monckton Copeman's report on the General Sanitary Circumstances and Administration of the Sutton Bridge Urban District. No. 299. 10 pp., fcp. London, 1908. *A. Newsholme, M.D., F.R.C.P., D.P.H.*

Lyster, *R. A., M.B., Ch.B., B.Sc., D.P.H.* School Hygiene. 368 pp., 8vo. London, 1908. *The Author.*

Notter *and* **Firth.** Theory and Practice of Hygiene. Revised and largely rewritten by Lt.-Col. R. H. Firth, F.R.C.S., R.A.M.C. 1,008 pp., 8vo. London, 1908. *J. & A. Churchill (publishers).*

Nottingham. The Meteorology of, for the Year 1907. 8 pp., fcp. Nottingham, 1907. *A. Brown, M.Inst.C.E.*

Ontario. Thirty-sixth Annual Report relating to the Registration of Births, Marriages, and Deaths, for the year ending 31st December, 1905. 226 pp., 8vo. Toronto, 1907. *C. A. Hodgetts, M.D.*

Peterhead. Report on the Origin and Spread of the Epidemic of Typhoid Fever in 1907. 47 pp., fcp. Peterhead, 1908.
Professor Matthew Hay, M.D.

Registrar-General. Sixty-ninth Annual Report of Births, Deaths, and Marriages in England and Wales, 1906. 682 pp., 8vo. London. 1908.

——— Sixty-ninth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England and Wales (1906). 682 pp., 8vo. London, 1908.
The Registrar-General.

Reid, *George, M.D., D.P.H.* Practical Sanitation: a Handbook for Sanitary Inspectors and others interested in Sanitation, with an Appendix on Sanitary Law, by Herbert Manley, M.A., M.B., D.P.H. Thirteenth Edition. 363 pp., 8vo. London, 1906. *Charles Griffin & Co., Ltd. (publishers).*

Richmond, *G. E., M.D., B.Sc., D.P.H.* An Essay upon Disease, its Cause and Prevention. 96 pp., 8vo. London, 1907. *H. K. Lewis (publisher).*

Spiers, *Ernest J., B.A., C.E.* The Neutral Axis in Reinforced Concrete Beams: being a Paper read before a meeting of students of the Institution of Civil Engineers, Friday, 24th January, 1908. 10 pp., fcap. London, 1908.
The Author.

Strachan, *H., C.M.G., L.R.C.P., M.R.C.S., F.L.S.* A Course of Simple Lectures on Elementary Hygiene delivered for the Instruction of the Public of Lagos, West Africa, in 1901. Second Edition, 1905. 149 pp., 8vo. London, 1906.
The Author.

Tasmania. Report of the Chief Health Officer and the Surveyor-General on certain matters in connection with the Gathering Ground and Sources of the Hobart Water Supply. 8 pp., fcp. Hobart, 1905.
J. S. C. Elkington, M.D., D.P.H.

United States of America. Report of the Commission of Education for the year ending June 30th, 1906. Volume I. 690 pp., 8vo. Washington, 1907.
Commissioners of Education.

United States Geological Survey. *Department of the Interior.* The Potomac River Basin. 367 pp., 8vo. Washington, 1907. *W. Whitaker, B.A., F.R.S.*

Venice. L'Ospedale per i tuberculosi in S.M. delle Grazie nel suo primo anno di esercisio. 20 pp., 8vo. Venice, 1908.
Il Segretario, Dell' Ufficio Case Popolari.

Water Undertakings. Analysis of the Accounts of some of the Principal, of the United Kingdom, for the Year 1906—1907. 19 pp., 4to. London, 1907. *Wood, Drew & Co. (Chartered Accountants).*

NEW PREMISES FUND.

	£	s.	d.
Amount Allotted by Council	9,000	0	0
Cash received in Donations, etc., 1899–1906 ...	1,338	19	0
Promises of Donations & Subscriptions, already reported to July, 1907	1,000	10	6
Promises of Donations to the Douglas Galton Gallery	110	10	0

Contributions to December 31st, 1907.

Miss E. Miller	0	9	8
F. J. Paris (4th Donation)	0	5	0
W. T. Toogood (3rd Donation)	1	1	0
	£1	15	8

Contributions received during 1908.

Miss L. H. Arnold (3rd Donation)	0	10	6
H. Catchpole (3rd Donation)	0	10	6
Miss M. A. Chappell (2nd Donation)	0	5	0
R. M. Chart	2	2	0
Alderman William Dunk (2nd Donation)	1	1	0
T. J. Fisher (2nd Donation)	2	2	0
F. W. King (4th Donation)	1	1	0
Miss E. L. Maynard	0	10	6
Miss E. Miller (2nd Donation)	0	9	8
J. G. Victor Sapp (3rd Donation)	2	2	0
Miss M. Stapylton	0	10	6
C. W. Ward	0	10	6

March 24th, 1908.

FURTHER EXHIBITS FOR WHICH MEDALS HAVE BEEN AWARDED AT THE SCHOOL BUILDING AND FURNISHING APPLIANCES EXHIBITION, 1907.

"Plastoment Flooring."

Bronze Medal.

To The Plastoment Asbestos Flooring Co., Lambs Passage, Bunhill Row, E.C.

"Plastoment" is laid in a plastic state in two layers of $\frac{3}{8}$ in., total thickness $\frac{3}{4}$ in. The first layer is specially insulating, the second is the finishing layer in plain or combination of colours, with a fine and even surface. It can be laid on Portland cement concrete, wood, iron, stone, brick, tiles, &c. (old or new), but not upon lime or plaster. The plain colours in which "Plastoment" can be laid, are white, grey, brown, black, yellow, and red. The mixed colours, a combination of two or more of the above (in appearance, similar to marble terrazzo mosaic); also a mixture of any two colours to imitate various marbles. Borders can be laid in various designs.

Prices vary according to quantity and finish.

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To the British Dolomenl Flooring Co., Ltd., Caxton House, Westminster.

Dolomenl is laid in a double layer of a total thickness of $\frac{1}{2}$ in., without a single join, and can be finished in many colours and designs to imitate granite, mosaic, or marble. It can be laid on any surface, whether concrete, cement, or wood.

Full particulars and prices on application.

Anti-flooding Valve, with screened float chamber.

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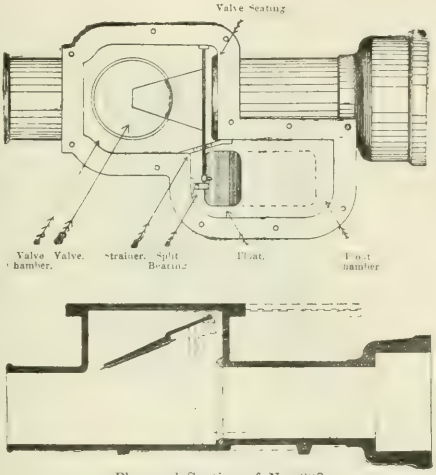
To JOHN JONES (CHELSEA), LTD.



Plan and Section of No. 308.

The valve hangs in a chamber above the drain when working under normal conditions, but upon the flood water rising, the float in the adjoining chamber rises with it and closes the valve; when the flood water recedes, the float falls and raises the valve; directly the valve is opened, the water in the upper part of the drain commences to flow and impinges against the valve face, leaving it clean and ready for further action. The float chamber is separated from the valve chamber by a perforated screen; this allows the water to enter, but excludes solids.

Numerous patterns and sizes, ask for "Eureka" Anti-flooding List.

SIZES.—4 in.; 5 in.; and 6 in.

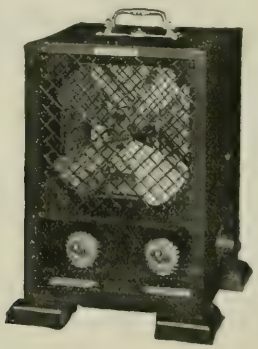
PRICES.—4 in., £3; 5 in., £3 10s.; 6 in., £4.

Manufactured by JOHN JONES (CHELSEA), LTD., Carlisle Works, Chelsea, S.W.

Combined Ventilating and Ozonizing Appliances.

Bronze Medal

To Ozonair, Ltd.



By the Ozonair System the air is first thoroughly cleansed of all solid impurities, much of the noxious gases found in all large towns at the same time being removed. It is then mixed with a certain small percentage of pure ozone, which renders it remarkably fresh and invigorating. From the mixing chamber it is distributed to the various portions of the building by means of ducts, etc. The foul air is removed by extraction fans or otherwise.

Sizes.—From about ½ cubic foot upwards.

Prices.—From £9 15s. upwards.

Manufactured by Ozonair, Ltd., 27, Chancery Lane, London, W.C.

THE ROYAL SANITARY INSTITUTE

ANNUAL REPORT OF THE COUNCIL

FOR THE YEAR 1907.

Read at the Ordinary General Meeting, April 15th, 1908.

INTRODUCTION.

The Council in this report for the year 1907, are glad to be able to record a continued development and expansion in all the various branches of work in which the Institute is engaged.

The year has witnessed a most successful culmination to the efforts of the Organising Committee on behalf of the Second International Congress on School Hygiene, in which the Institute was largely interested. The Congress met in London in August, and it was attended by over 1,500 people, a large number of official delegates from foreign countries being included in the membership. The Exhibition of School Building and Furnishing Appliances, which was arranged by the Institute in connection with the Congress, and which attracted a good deal of attention, is referred to later on in this report. A brief and necessarily cursory survey of the work done and the papers read at the Congress was given in the October number of the Journal.

OTHER ASSOCIATED WORK.

The Council are pleased to be able to record the increasing use which is being made of the Institute for the purpose of reference and enquiry on all matters relating to sanitation. During the year they have been called upon to advise the Crown Agents for the

Colonies, with regard to the appointment of a Chief Sanitary Inspector for Perak, and applications for assistance and information have been dealt with from the American Embassy, the German Consulate, the Agent-General for Tasmania, the Columbia University, New York, the Ministry of Public Works, Cairo, from Paris, East London, and Chicago; as well as from a number of municipalities and other bodies in Great Britain. The special Advisory Committee appointed by the Council to deal with applications for advice and help are always ready to give consideration to requests from the Members.

The Council appointed four delegates to represent the Institute at the Fourteenth International Congress of Hygiene and Demography, which was held at Berlin in September. A note of the Congress by Sir Shirley Murphy, who was one of the delegates, appeared in the November number of the Journal.

NEW PREMISES.

In this matter the Council have not yet been successful in settling upon a scheme for re-housing the Institute. The necessity for making adequate provision for the Museum, renders it a matter of much difficulty to obtain a building or site in a suitable part of London, which is sufficiently large to meet the requirements, and which can be obtained at a price within the means which the Council have at their disposal.

SANITARY LEGISLATION.

The Council had under consideration the following Bills introduced into Parliament during the year. The action taken by the Council and the fate of the Bill is noted in each case :—

Public Health Bill. Presented by Mr. J. W. Wilson, supported by Mr. Harmood-Banner, Mr. S. Roberts, Mr. Arthur Henderson, Mr. Staveley-Hill, and Mr. Whitley.

To enable urban authorities to adopt the benefit of many clauses, which, having been introduced into Private Bills of recent years, have been accepted by Parliament, and to confer upon the Local Government Board the power to extend the Act to Rural Districts. The Bill contained sections dealing with streets, buildings and sewers, sanitary provisions, infectious diseases, milk supply, common lodging houses, recreation grounds, fire brigade, slaughter houses, &c.

Decided to petition in favour of the Bill, which received the Royal assent.

This Act is an important product of the work of the Parliamentary session from the point of view of the public health. It should accomplish a very necessary work in the direction of the standardisation and co-ordination of methods of sanitary administration throughout the country. Although the Act is adoptive, it is to be hoped that local authorities generally will take advantage of the many facilities it affords for improving and rendering more effectual the public health service and control.

Public Health Officers Bill. Ordered to be brought in by Sir Walter Foster, Sir Francis Powell, Sir John Tuke, and Mr. Rainy.

To ensure that none but those properly qualified shall be appointed as Medical Officers of Health or Sanitary Inspectors, and to give all such officers and inspectors security in their tenure of office.

No action was taken, and the Bill was dropped.

Local Authorities Officers Bill. Presented by Mr. Luke White, supported by Mr. Barnard, Captain Balfour, Sir Joseph Leese, Mr. Napier, and Mr. H. W. Forster.

To extend the provisions of the Poor Law Officers' Superannuation Act, 1896, to Urban District Councils who may wish to adopt them; and to deal with the question of tenure of office.

No action was taken, and the Bill was dropped.

Housing of the Working Classes, &c., Bill. Presented by Mr. Bowerman, supported by Mr. Alden, Mr. Bell, Sir J. H. Bethell, Mr. Nannetti, Mr. Steadman, Mr. Thorne, and Mr. Wiles.

Extends the period for which money may be borrowed by local authorities to 100 years, and generally deals with administrative and political questions.

Decided that no action be taken, as the Bill contained so many provisions which were outside the province of the Institute. The Bill was dropped.

Housing of the Working Classes Acts Amendment Bill. Ordered to be brought in by Sir Walter Foster, Sir Francis Channing, Mr. Soames, Mr. Eve, Mr. Hart Davies, and Mr. Nicholls.

To facilitate the building of houses for the working classes in rural districts.

Decided that no action be taken, as it was understood that the Government intended to introduce a Bill dealing with the subject. The Bill was dropped.

Factory and Workshop Act (1901) Amendment Bill. Presented by Mr. Cameron Corbett, supported by Mr. Crombie, Mr. Arthur Henderson, Mr. Ramsay Macdonald, and Mr. Trevelyan.

To distribute the working hours in laundries more regularly over the week; to regulate the daily working hours; and to bring within the scope of the Factory Act the laundries in religious and charitable institutions, and the smaller laundries.

No action was taken, and the Bill was dropped.

Factory and Workshop Act (1901) Amendment (No. 2) Bill. Presented by Mr. Jowett, supported by Mr. Snowden, Mr. Steadman, Mr. Wardle, Mr. O'Grady, Mr. Hudson, and Mr. George Roberts.

To prohibit persons employed as operatives in certain factories and workshops, from working between noon on Saturdays and six o'clock a.m. on the following Monday, except for certain specified purposes.

No action was taken, and the Bill was dropped.

Home Work Regulation Bill. Presented by Mr. Ramsay Macdonald, supported by Mr. Crooks, Mr. Fenwick, Mr. George Roberts, Mr. Ernest Lamb, Mr. Billson, Mr. Fiennes, Sir Gilbert Parker, and Mr. Mitchell-Thomson.

To provide for the better regulation of home industries by the certification of all persons to whom work is given to be done at their homes.

Decided to petition against the Bill as the licensing system proposed would prove cumbersome and impossible. Under the Public Health Acts and the Factory and Workshop Act adequate machinery for the purpose of sanitation already existed, and the licences would be of no assistance in the administration of these Acts; the Council considered it very undesirable to place autocratic powers in the hands of an official, whether of the State or of a Municipality, and as the forfeiting of a licence, even for a short period only, might entail the loss of a man's livelihood (a penalty which in every other licensed business is imposed by a magistrate only), they were of opinion that the intervention of the magistrate between the official and the public was essential, not only to justice, but to make justice apparent.

The Bill was dropped.

Public Health (Regulations as to Food) Bill. Presented by Mr. John Burns, supported by Dr. Macnamara.

To enable regulations to be made for the prevention of danger arising to the public health from the importation, preparation, storage, and distribution of articles of food.

Decided to petition in favour of the Bill, which received the Royal Assent.

Diseases of Animals Act (1896) Amendment Bill. Presented by Mr. Cairns, supported by Mr. H. Greenwood, Mr. Robert Price, Mr. Baker, Mr. Halley Stewart, Mr. Maddison, Sir Gilbert Parker, Mr. Ramsay Macdonald, Mr. A. Henderson, Sir F. Cawley, Mr. Cross, and Mr. Crooks.

To permit the landing in Great Britain of Canadian cattle, without such cattle being subject to the provisions of the Diseases of Animals Act, 1894, as to slaughter or quarantine.

No action was taken, as the Bill did not appear to contain any sanitary provisions. The Bill was dropped.

Butter and Margarine Bill. Presented by Sir Edward Strachey.

To limit the amount of moisture in butter, margarine, and butter substitutes, and to provide for the registration and inspection of Butter and Margarine Factories.

Decided to petition in favour of this Bill, and to urge the Local Government Board to include an amendment dealing with itinerant vendors of butter and margarine. The Bill received the Royal Assent.

Municipal Milk Depôts Bill. Presented by Mr. John Burns, supported by Dr. Macnamara.

To authorise and regulate the establishment of milk depôts by certain local authorities.

Decided to petition in favour of the Bill, which was, however, withdrawn.

Infant Life Protection Bill. Presented by Mr. Staveley Hill, supported by Sir John Kennaway, Mr. Arthur Lee, Mr. Hay, Mr. Walrond, Mr. Ramsay Macdonald, Mr. Hills, and Mr. Nicholls.

To extend the provisions of the Infant Life Protection Act, 1897, to cases where only one child is taken in to be nursed or maintained, and to provide for more efficient inspection and supervision of such children.

Decided to petition in favour of this Bill, which was eventually dropped.

Education Acts (Amendment) Bill. Presented by Mr. Walter Rea, supported by Mr. Shackleton, Mr. Frederick Edwin Smith, Mr. Tomkinson, Mr. Williamson, Mr. Guest, Mr. Masterman, and Mr. Tennant.

To make provisions for Vacation Schools and for the Medical Inspection and Treatment of School Children.

Decided to petition in favour of this Bill, which was, however, dropped.

Notification of Births Bill. Ordered to be brought in by Lord Robert Cecil, Mr. Lyttelton, Mr. Shackleton, Mr. Verney, Mr. Gulland, Mr. Masterman, Mr. Sherwell, and Mr. Tennant.

To provide for the notification in writing to the Medical Officer of Health of all births in his district within thirty-six hours of the birth.

Decided to petition in favour of this Bill, which received the Royal Assent.

Vaccination Bill. Presented by Mr. John Burns, supported by Dr. Macnamara.

To substitute a statutory declaration for the certificate required under section 2 of the Vaccination Act, 1898, of conscientious objection.

No action was taken. The Bill received the Royal Assent.

SPECIAL PUBLIC LECTURE.

In March a public lecture was given in the Museum by Professor Ronald Ross, C.B., F.R.C.S., D.SC., F.R.S., on "Points of Interest connected with Tropical Sanitation." His Grace the Duke of Northumberland, K.G., President of the Institute, took the chair at this meeting. The lecture was illustrated with an interesting series of lantern slides depicting the various works undertaken to prevent the spread of tropical diseases, and there was a large attendance of members and others. The lecture is printed in the May number of the Journal.

SESSIONAL MEETINGS.

Meetings were held in London in March, April, May, October, and November; and during the year in the following towns: Stafford, Newcastle-upon-Tyne, Eastbourne, Plymouth, Montreal (Canada), Ipswich, Leeds, Manchester. The discussions were in most cases arranged in the morning, and demonstration visits were

made in the afternoon to sanitary works, relating, where possible, to the subjects discussed. There was an attendance at the various meetings ranging from 45 to 175.

The Royal Sanitary Institute is indebted to Dr. George Reid, Dr. H. E. Armstrong, Dr. W. G. Willoughby, Dr. F. M. Williams, Prof. T. A. Starkey, Dr. A. M. N. Pringle, Dr. J. Spottiswoode Cameron, and Prof. J. Radcliffe, who very kindly acted as local secretaries and organised these successful meetings.

The following subjects were brought forward:—

"To what extent must Authorities purify Sewage?" by George Reid, M.D., D.P.H.; Colonel J. Lane Notter, R.A.M.C., Chairman of Council, in the chair.

"The Bacterial Treatment of Sewage, with special reference to the Biolysis of Organic Nitrogen," by W. D. Scott-Moncrieff; the Chairman of Council in the chair.

"A Sketch of the Sanitary History of Newcastle-upon-Tyne," by J. Coote Hibbert, M.D., D.P.H., and W. H. Wells; the Chairman of Council in the chair.

"The Aim and Scope of Women's Work in relation to Public Health," by H. Meredith Richards, M.D., B.SC.; the Chairman of Council in the chair.

"The Main Drainage of Eastbourne," by A. E. Prescott; "Description of the Eastbourne Isolation Hospital," by W. G. Willoughby, M.D., D.P.H.; the Chairman of Council in the chair.

"Suggested Amendments of the London County Council By-laws as as to Drainage," by Louis C. Parkes, M.D., D.P.H., J. Patten Barber, M.INST.C.E., and Isaac Young; Sir Shirley F. Murphy, Vice-President, in the chair.

"Infant Mortality," by Major R. J. Blackham, D.P.H., R.A.M.C.; the Chairman of Council in the chair.

"Typhoid Fever," by F. C. Douglas, M.D., D.P.H., and Adjourned Discussion on "Typhoid Fever," by Prof. T. A. Starkey, M.B., D.P.H.

"The Recent Report of the Royal Commission on Tuberculosis," by A. M. N. Pringle, M.B., C.M., D.P.H.; Colonel J. Lane Notter, R.A.M.C., Deputy-Chairman of Council, in the chair.

"The Smoke Problem in Large Towns," by Louis C. Parkes, M.D., D.P.H., and H. A. Des Voeux, M.D.; Sir William B. Richmond, K.C.B., R.A., in the chair.

"Modern Methods of Sewage Disposal, with special reference to the Elimination of Suspended Matters," by G. A. Hart; H. D. Searles Wood, F.R.I.B.A., Chairman of Council, in the chair.

"Butter Supply," by L. Wilson, and "Small Dwellings," by Prof. J. Radcliffe, M.SC.TECH.; the Chairman of Council in the chair.

The meetings in provincial centres appeared to be much appreciated by the Members and Associates, and the Council were able to

arrange for meetings in one or two centres, where facilities had not previously been afforded for the members to discuss matters of mutual interest.

Attention should be called to the fact that the two meetings held in Montreal, at which the subject of Typhoid Fever was discussed, were the first meetings of the kind held outside Great Britain. The Council trust that other Colonial centres where Examination Boards are already in operation, may see their way to develop their work in this direction.

A full record of the proceedings is given in the Journal, so that all the Members and Associates have the opportunity of reading the papers and notes of discussions.

In connection with the meetings, visits were made to:—

Hanley Sewage Disposal Works; Staines Sewerage Works, Ashford; City Hospital and Royal Victorian Infirmary, Newcastle-upon-Tyne; Ejector Station, the Destructor, Electric Light Works, Corporation Motor Omnibus Station, Sewer Outfall, and Corporation Hospital, Eastbourne; Plymouth Royal Dockyard and Co-operative Society's Bakery; Ipswich Electricity Station and the East Suffolk and Ipswich Hospital; Headingley Waterworks Filter Beds, the Rodley Sewage Works, and the Leeds City Fever Hospital; and the Salford Sewage Purification Works.

Hospitality was extended to the members by W. D. Scott-Moncrieff; Dr. H. E. Armstrong; the Chairman and Sanitary Committee of Eastbourne; the Plymouth Co-operative Society; the Hospitals Committee and the Tramways Committee, Leeds; and was much appreciated by the Council and Members, as adding to the pleasure and success of the meeting.

MEETING OF ASSOCIATES.

This Meeting has now become an annual feature in the Institute's calendar, and the Council believe that it serves a useful purpose by affording Associates an opportunity of offering suggestions with regard to the work of the Institute. At the third of these meetings, which was held in March, Colonel J. Lane Notter, R.A.M.C., Chairman of Council, occupied the chair, and Dr. Louis C. Parkes brought forward the subject of "The Training of Sanitary Inspectors before taking office." The address evoked a useful discussion, and several suggestions were put forward by Associates with regard to the training and examination of inspectors. These suggestions were duly taken into consideration by the Council, and as a result of

the meeting it was decided to establish an examination, qualifying for membership, in the advanced knowledge of the carrying out of an inspector's duties. A report of the meeting appears in the June number of the Journal, and particulars of the new examination are given in the last number of the Journal for the year.

LECTURES AND DEMONSTRATIONS ON SANITARY SCIENCE.

Two Courses of Training for Sanitary Officers were held during the year, in the Spring and the Autumn, being the 43rd and 44th Courses held by the Institute. Thirty-six students entered for the Spring Course: and for the Autumn Course fifty-three were enrolled. A complete list of each course of lectures was given in the supplementary pages of the Journal.

Inspections and Demonstrations.

In connection with the Courses of Lectures the usual visits to public works illustrative of sanitary practice and administration were arranged.

The Institute is indebted to the London County Council, to Metropolitan Borough Councils and to District Councils, and others who are so kindly assisting them with regard to the visits, and in bringing the lectures under the notice of their officers.

Practical Training for Meat Inspectors.

In addition to the Course of general Lectures for Sanitary Officers, special Courses were arranged during the year for candidates preparing for the Examination for Inspectors of Meat and other Foods, conducted by the Institute.

At the Spring Course there were 35 Students, and at the Autumn Course 9 Students.

Two Special Courses of Training in Food and Meat Inspection for Commissioned Officers and Professional Men were arranged during the year. The Spring Course was attended by 6 students, and the Autumn Course by 6 students.

Sanitary Science as Applied to Buildings and Public Works.

In addition to the Courses of instruction reported above, a Course was arranged to meet the needs of candidates going up for the Examination in Sanitary Science as applied to Buildings and Public Works. The Course, which was first held in the Spring of 1906,

covers the subjects set out in the Examination Syllabus. Four students attended the Spring Course, and the Autumn Course was attended by five students.

HYGIENE IN ITS BEARING ON SCHOOL LIFE.

The short Course of Lectures on Hygiene in its bearing on School Life, which was instituted in 1906, was repeated during 1907. The Course is arranged to assist teachers and others interested in the training of children and the structural conditions of the school, who purpose entering for the Examination in Hygiene in its bearing on School Life. It consisted of lectures and practical demonstrations relating to Personal Hygiene, and to Schools, Buildings, and Equipment. A nominal fee was charged for these Lectures, and for the Spring Course 7 students entered their names, and 6 students attended the Autumn Course.

EXAMINATIONS.

The following Examinations have been held during the year :—

IN SANITARY SCIENCE AS APPLIED TO BUILDINGS & PUBLIC WORKS.

Birmingham	Glasgow	Newcastle-upon-Tyne
Bristol	Hong Kong (2)	Norwich
Blackburn	Hull	Perth, W.A.
Cape Town	Leeds	Plymouth
Cardiff	Liverpool (2)	Worcester
Derby	London (2)	
Edinburgh	Manchester (2)	

At these Examinations 122 Candidates presented themselves, to 42 of whom Certificates were granted.

FOR INSPECTORS OF NUISANCES.

Adelaide, S.A.	Inverness
Birmingham	Kimberley
Blackburn	Leeds
Brisbane	Liverpool (2)
Bristol	London (2)
Cardiff	Manchester (2)
Derby	Newcastle-upon-Tyne
Dublin	Norwich
Edinburgh	Plymouth
Glasgow	Perth, W.A. (2)
Hong Kong (2)	Worcester
Hull	

At these Examinations 807 Candidates presented themselves, and 389 were certified competent, as regards their Sanitary knowledge,

to discharge the duties of an Inspector of Nuisances under the Public Health Act, 1875.

The Sanitary Inspectors Examination Board (formed by The Sanitary Institute and other bodies), for holding Examinations under the Public Health (London) Act, 1891, held three Examinations during the year. There were 46 Certificates granted.

For Inspectors of Meat and Other Foods.

Birmingham	London (2)
Bristol	Manchester
Edinburgh	Perth, W.A.
Leeds	

At these Examinations 153 candidates presented themselves, to 97 of whom Certificates were granted.

In Hygiene in its Bearing on School Life.

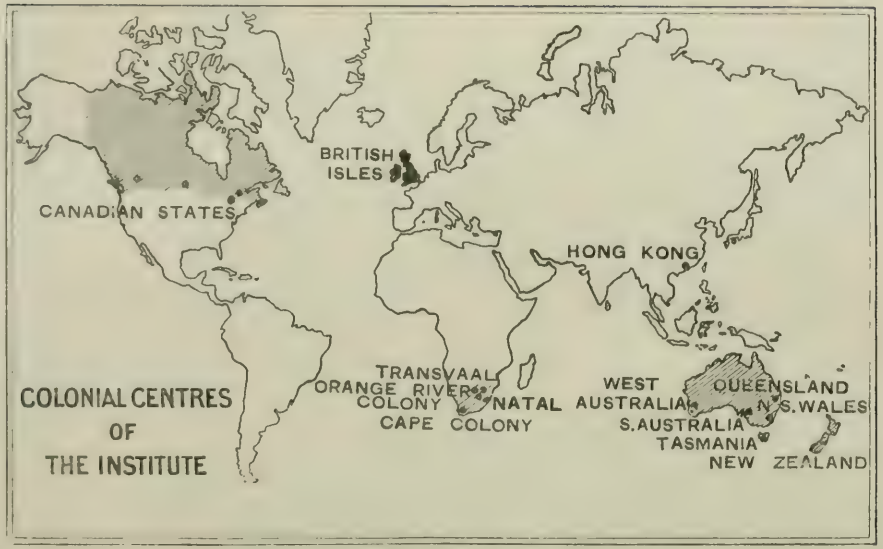
Birmingham	London (2)
Blackburn	Manchester (2)
Derby	Newcastle-upon-Tyne
Edinburgh	Plymouth
Leeds	Worcester
Liverpool (2)	

At these Examinations 89 Candidates presented themselves, to 56 of whom Certificates were granted.

The Council are pleased to report a considerable increase in the number of Candidates who have entered for the Examinations in Sanitary Science as applied to Buildings and Public Works, and for Inspectors of Meat and other Foods. It was thought advisable to increase the centres at which this latter Examination could be taken, and the action of the Council has been justified by the number of candidates who have taken advantage of this opportunity of testing their knowledge.

COLONIAL EXAMINATIONS.

A map of the World is printed in this report, showing the Colonies in which branches of the Institute have been established, and marking also the towns in which Examinations have been held or special representative Boards formed.



COLONIAL CENTRES OF THE INSTITUTE.

Shewing the extension of its work to other parts of the Empire.

Continued interest is being taken by Public Health Officers in the Colonies in the subjects of Meat Inspection and School Hygiene. The Meat Inspectors' Examination has recently been extended to Western Australia.

Several of the Local Boards of Examiners have expressed their wish that Examinations in these subjects should be held in their centre, and the Council hope that in the course of 1908 it may be found possible for these Examinations to be extended.

During the year Examinations were held in Adelaide, South Australia; Brisbane, Queensland; Perth, Western Australia (2); Kimberley and Cape Town, South Africa; and Hong Kong (2).

Arrangements are in progress for Examinations in Canada, New South Wales, Tasmania, and New Zealand, and Lectures are being arranged preparatory to Examinations in 1908.

The Council desire to place upon record the sense of their indebtedness to the Members and Officers of the Examination Boards in the several Colonies, for the services they have rendered in the development of the Institute's training and examination work in distant parts of the Empire. The Council feel that it is to the untiring zeal and energy displayed by the Members and Officers of the Colonial Boards that the great success which has been achieved is due. This work will prove of real public benefit by facilitating effective sanitary administration in the Colonies.

South Australia.

The first Examination held by the Board took place at Adelaide in June last, when twenty-one candidates presented themselves for the Inspectors of Nuisances Examination, and twelve certificates were awarded.

Queensland.

An Examination was held in Brisbane in July last. Seven candidates presented themselves for the Inspectors of Nuisances Examination, and six certificates were awarded.

Arrangements are now being made to hold an Examination in Brisbane annually, and the Commissioner for Public Health (Dr. Burnett Ham) is actively taking up the question of School Hygiene, and it is hoped a course of Lectures will be organised, previous to an examination being held in this subject, in 1908.

Western Australia.

Two Examinations have been held in Perth, Western Australia, this year. In April nine candidates presented themselves for the Inspectors of Nuisances Examination, and eight certificates were awarded.

In December last, Examinations were held in Sanitary Science as applied to Buildings and Public Works, for Inspectors of Nuisances, and for Inspectors of Meat and other Foods, this being the first Meat Inspectors' Examination in this centre. Seven candidates presented themselves for the Sanitary Science Examination, and six certificates were awarded. Nineteen candidates took the Inspectors of Nuisances Examination, and twelve certificates were awarded. For the Meat Inspectors' Examination nine candidates presented themselves, and seven certificates were awarded.

Courses of Lectures and Practical demonstrations were held at the Technical Schools, Perth, previous to the Examinations.

Dr. Ernest Black, who has actively assisted the Board since the Examinations were established, has resigned his position as Chairman of the Board, and has been succeeded by Dr. T. H. Lovegrove, M.R.C.S., the President of the Central Board of Health, Perth.

The following have been elected as additional Members of the Board:—F. B. Allen, M.A., Director of Technical Education, Perth; H. Oldham, Assoc.M.Inst.C.E., Engineer for Water Supply and Sewerage, Public Works Department, Perth; H. T. Haynes, Assoc. M.Inst.C.E., City Engineer, Perth.

South Africa.

Two Examinations have been held in South Africa during the year. At Kimberley seven candidates presented themselves for the Examination for Inspectors of Nuisances, and three certificates were awarded. At Cape Town, one candidate presented himself for the Sanitary Science Examination, to whom a certificate was awarded, this being the first Sanitary Science Examination in this centre.

Mr. R. W. Menmuir, Engineer to the Municipality of Woodstock, has been elected as a Member of the Board, to fill the vacancy caused by Mr. John Cook's resignation.

Hong Kong and South China.

Two Examinations have been held in Hong Kong this year. In May, three candidates presented themselves for the Sanitary Science Examination, but no certificates were granted, and ten candidates

presented themselves for the Inspectors of Nuisances Examination, seven certificates being awarded.

In October, one candidate took the Sanitary Science Examination, to whom a certificate was granted, and of the six candidates for the Inspectors of Nuisances Examination, four were awarded certificates.

Examinations were established by the Institute in 1877, and the following figures show the total number of Examinations held and the number of candidates:—

	Examinations.	Candidates entered.	Candidates certified.
For Local Surveyors	35	291	142
Sanitary Science as applied to Buildings and Public Works	146	845	356
Inspectors of Nuisances	262	11,674	6,106
Inspectors of Meat and other Foods ..	40	587	390
Hygiene in its Bearing on School Life .	41	273	167
	524	13,670	7,161

CONFERENCE AT DUBLIN.

The Conference was held in the Trinity College, Dublin, from June 25th to 29th, 1907.

His Excellency the Right Hon. Earl of Aberdeen, P.C., G.C.M.G., Lord Lieutenant of Ireland, accepted the office of Patron of the Conference, and responded for the Institute at the Dinner given by the Provost and Fellows of Trinity College.

The Inaugural Address was given, in the absence through ill-health of the President, the Earl of Rosse, by Sir Charles Cameron, C.B., M.D., on June 25th in Trinity College, the Provost of Trinity College in the Chair.

The business of the Conference was divided into three Sections, one Section sitting each day. By this arrangement, all the members had an opportunity of attending each discussion.

Section I.—Sanitary Science and Preventive Medicine.

Subjects for discussion—

"Poor Law and Sanitary Administration in Ireland";

"The Rôle of Sanatoria as a factor in checking Tuberculosis."

Section II.—Engineering and Architecture.

Subjects for discussion—

"The Economic Housing of the Working Classes in Town and Country";

"Could the Existing Statutory and Departmental Requirements as to Sewage Disposal be relaxed in certain cases with advantage to the Community?"

Section III.—Physics, Chemistry, Biology, and Meteorology.

Subjects for discussion—

"The Climatology of Ireland in relation to Public Health";

"Disinfection considered from a Medical, Chemical, and Meteorological Standpoint."

The papers, together with the discussions, appear in the Journal for August and September.

During the meeting excursions and visits were made to Messrs. Guinness's Brewery; St. Patrick's Cathedral; the Iveagh Trust Buildings; the Science and Art Museum under the guidance of the Director, Colonel Plunkett; the New Main Drainage Outfall Works; Glendalough and the Seven Churches, and Killarney.

The members were graciously entertained at a Garden Party by Their Excellencies the Lord Lieutenant and the Countess of Aberdeen, and at a Smoking Concert by the Rt. Hon. the Lord Mayor of Dublin.

The numbers attending the Conference were as follows:—Delegates, 365; Members and Associates of the Institute, 75; Associates of the Congress, 22; Complimentary and Press, 90; making a total of 552.

Delegates were appointed by 182 Authorities and learned Institutions.

EXHIBITION IN LONDON.

The Exhibition of School Building and Furnishing Appliances was held in connection with the Second International Congress on School Hygiene in the great Hall, and East and West Galleries of the London University, South Kensington, and was open for nine days. It was attended by the delegates to the Congress, and by many other visitors. A list of the Exhibits for which medals were awarded is given in the Supplement to the September number of the Journal, and also a list of certain Exhibits which required special test before their merits could be decided upon by the Judges. An illustrated list of these premiated exhibits appeared in the last number of the Journal for the year.

LIBRARY.

Volumes and Pamphlets numbering 380 have been presented to the Library. Lists of these were published in the Supplement to the Journal.

Many of the books presented to the Library were of exceptional interest, and the collection of volumes which the Library now contains is a very valuable asset. With the rapidly growing literature of Sanitary Science, the question of accommodation for the books becomes increasingly urgent. The value of a library devoted to a special branch of knowledge must depend upon the easy accessibility of the information which it contains, and the Council fear that the full value of the Institute's Library is somewhat lessened on account of the great difficulty which is experienced in suitably classifying and exhibiting the books in the small space which is at present available.

In another direction also the lack of accommodation is seriously hampering the educational value of the Library. The large number of meetings and lectures now held by the Institute renders it necessary frequently to disturb the readers, so that the room may be cleared for a meeting, and even apart from this, the enforced use of the Reading Room for office purposes is very undesirable, as it is not possible, where such a use is made of the room, to obtain the conditions which are essential to careful reading and study.

JOURNAL.

The Editing Committee has endeavoured to keep the reports in the Journal as concise as possible, bearing in mind at the same time the importance of giving clear and satisfactory reports of the various meetings; and they believe that the reduction in the number of pages of the Journal which has been effected, is an advantage.

The Dublin Conference being on a smaller scale than the usual Congresses of the Institute, also partly accounts for the reduction in the present Volume.

The Journal for 1907 contains 524 pages, in addition to 204 pages of Supplemental matter.

INSTITUTE DINNER.

His Grace the Duke of Northumberland, K.G., President, took the chair at the Dinner of the Institute, held at the Langham Hotel on May 9th, at which there were 80 Members and others present.

PARKES MUSEUM.

Additions to the number of forty-two have been made to the collection of appliances in the Parkes Museum during the year, and these have been reported and described in the Supplement to the Journal. Instructive exhibits have been added to the School Furniture Section from the Exhibition of School Building and Furnishing Appliances; and the House Drainage Section and the Clothing Section have also been added to.

In the month of May, two members of the suite of H.I.H. Prince Fushimi of Japan paid a visit to the Institute and were conducted round the Museum. They were much interested in the collection, and expressed their appreciation of the Institute's work.

The Museum has again been largely used by other institutions for purposes of demonstration to their students. The total number of students visiting the Museum in these organised classes was 1,549, and these classes represented 54 institutions. Lecturers and Professors attached to the various training institutions in London make use of the Museum for the practical instruction of their students, and the Museum therefore occupies an important place among the technical educational bodies of London.

The following is a list of the institutions from which classes have attended :—

Architectural Association.
Battersea Polytechnic.
Bedford College for Women.
Birkbeck College.
Borough Polytechnic, S.E.
Bow and Bromley Branch, East London College.
Bowes Road School.
Camberwell Green Scientific Society.
Cavendish Square Convent.
Charing Cross Hospital Medical School.
Croydon Polytechnic.
Dartford Technical Institute.
East Ham Technical College.
East London Technical College.
Froebel Educational Institute.
Guildford Technical Institute.
King's College, London.
Kingston Technical Institute.
L.C.C. Home Nurses Classes.
L.C.C. Science and Art Schools
Barnsbury Park.
Blackheath Road.
Bloomfield Road.
Brockley Road.
Chaumert Road.
Essendine Road.
Faunce Street.
Hackford Road.
Lavender Hill.
Sumner Avenue.
The Ashburnham.
The Stanley.
Thomas Street.
Tottenham Road.
William Street.
L.C.C. Training College for Women.
London School of Medicine for Women.

Middlesex Education Committee:
Acton and Chiswick Polytechnic.
Cranford School.
National Health Society.
National Society's Training School of Domestic Subjects.
National Training School of Cookery.
Northfield School, N.
Norwood Institute.
Oxford City Technical School.
Paddington (L.C.C.) Technical Institute.
Queen Victoria Jubilee Institute for Nurses.
Regent Street Polytechnic.
Richmond County School and Technical Institute.
Skinners Company's School (Girls).
St. George's Hospital Medical School.
University College, London.
Wandsworth Institute.
Whitelands Training College, Chelsea.
Woking Technical Institute.

The collection of lantern slides for lecture purposes still continues to be frequently used by the Members and Associates, 788 slides having been hired during 1907.

FINANCE.

The Accounts for the year show a balance of £548 12s. 4d. of receipts over expenditure. This balance is £143 more than the amount carried forward last year. The amount carried forward to cover dilapidations that may accrue under the lease has been added to by £70, and a slight addition has been made to the New Premises Fund. There was no ordinary Congress or provincial Exhibition, and the accounts of the Conference held in Dublin, and the Exhibition held in connection with the International Congress on School Hygiene, show a loss of about £90 to the Institute. The result on Examinations is about £300 better than last year.

OBITUARY.

It is with regret that the Council have to report the death of the following:—

Vice-Presidents: Sir Benjamin Baker, and Sir Joseph Fayrer.

Hon. Fellow: Professor Émile Trélat.

Fellows: Rt. Hon. Lord Thring, Patrick Doyle, Joseph Groves, George Hodson, J. A. Kingdon, Allan Macfadyen, Magnus Ohren, and G. R. Strachan.

Members: T. L. Fearon, Mrs. H. Head, Charles Johnston, John Smith, and T. V. Smith.

Associates: W. F. Bartram, E. T. Blake, Oswald Jacob, C. Killington, James MacIntosh, Jonathan Mason, Samuel Minty, Miss Laura Old, and W. J. Wells.

Special obituary notices were, in several cases, published in the Journal.

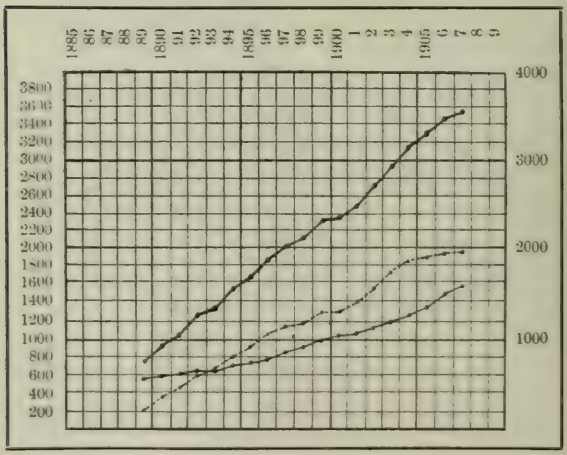
EPITOME OF REGISTERS OF MEMBERS AND ASSOCIATES.

The increase in the roll of the Institute for the year is 110 Members and Associates.

	Hon. Fellows.	Fellows.	Members.	Associates.	Total.
Dec. 31st, 1906	40	223	1,239	1,956	3,458
Dec. 31st, 1907	34	233	1,330	1,971	3,568

Diagram showing the Yearly Increase in the Roll of the Institute.

Fell. and Mem. ·—·—·—· Assoc. ····· Total ●—●—●—●



EPITOME OF THE WORK OF THE INSTITUTE, 1907.

	London Meetings and Examinations.	Total Attendance
6	Sessional Meetings and Public Lecture	471
129	Lectures and Demonstrations, Sanitary Officers, Sanitary Science, and School Hygiene Courses	5,341
60	Lectures and set Demonstrations on Meat Inspection, not including general instruction at the Cattle Market...	750
8	Examinations in Sanitary Science, for Inspectors of Nuisances, for Inspectors of Meat, and in School Hygiene	386
186	Council, Committee, Extraordinary and Ordinary General Meetings, and Associates' Annual Meeting..	1,116
112	Classes brought to Museum	1,549

Conference and Exhibition.

4	Sectional Meetings and Addresses at Dublin	895
	School Hygiene Exhibition, open for nine days (estimated)	10,000.

Provincial and Colonial Meetings.

9	Sessional Meetings	682
65	Examinations in Sanitary Science, for Inspectors of Nuisances, for Inspectors of Meat, and in School Hygiene	798

H. D. SEARLES WOOD,
Chairman of Council.

E. WHITE WALLIS,
Secretary.

April 8th, 1908.

STATEMENT of INCOME and EXPENDITURE

Dr. EXPENDITURE.	£ s. d.	£ s. d.
Establishment Charges:—		
To Rent, Rates, Taxes, and Insurance	503 11 8	
„ Salaries and Wages	1,664 7 0	
„ Coals, Lighting, and Care of Offices	93 3 0	
„ Repairs and Alterations	6 3 1	
„ Arrangement of Museum	7 18 9	
„ Library, Binding, &c.	3 18 1	
„ Postage, Telegrams, Telephone & Carriage	392 6 10	
„ Printing and Stationery	329 3 5	
„ Advertising	3 10 5	
„ Incidental Expenses	118 3 10	
„ Office Furniture	13 15 8	
„ Legal and Professional Charges	31 10 0	
„ Sinking Fund	70 0 0	
		3,237 11 9
Special Expenses, exclusive of Establishment Charges:—		
To Journal and Publications, Cost of Printing, etc., less Sales and Advertisements	235 10 3	
„ Sessional Meetings	109 4 3	
„ Lectures, Sanitary Officers	270 6 6	
„ „ School Hygiene	52 7 7	
„ „ Meat Inspectors	124 0 2	
„ Examination Expenses	1,734 16 3	
„ „ „ Colonial	228 19 11	
„ Conference at Dublin	227 3 3	
„ School Hygiene Exhibition	1,058 13 4	
„ Institute Dinner—Balance of Expenses	29 18 1	
		4,070 19 7
„ Balance carried down		548 12 4
		£7,857 3 8

ACCUMULATED

To Expenses on account of New Premises Fund		24 1 8
„ Depreciation of Investments since Dec. 31st, 1906		362 6 10
„ Balance to be carried forward to next account		5,932 0 4
		£6,318 8 10

for the Year ending 31st December, 1907.

INCOME.	£ s. d.	£ s. d.
		Cr.
General Receipts:—		
By Annual Subscriptions, less Arrears written off	2,613 7 0	
„ Interest on Investments, etc.	499 16 11	
		3,113 3 11
Special Receipts:—		
„ Lectures, Sanitary Officers	270 3 1	
„ „ School Hygiene	7 17 6	
„ „ Meat Inspectors	175 17 6	
„ Examinations	2,855 9 6	
„ „ Colonial	238 13 9	
„ Conference at Dublin	164 12 0	
„ School Hygiene Exhibition	1,031 6 5	
		4,743 19 9
		7,857 3 8

BALANCE.

By Balance brought forward from last account, 1906	5,769 16 6
„ „ for the year brought down	548 12 4
	£6,318 8 10

NEW PREMISES

	£	s.	d.
To Balance carried forward to next Account.....	10,420	0	8
	£10,420	0	8

SAXON SNELL

				£	s.	d.
To Expenses.....				0	1	7
„ Balance carried forward to next Account:—						
Funded Capital	700	0	0			
Balance available for Prizes and Expenses ..	54	2	3			
				754	2	3
				£754	3	10

GENERAL BALANCE SHEET,

LIABILITIES.	£	s.	d.	£	s.	d.
To Fees and Subscriptions paid in advance for 1908	200	1	6			
„ Sundry Creditors	1,155	5	2			
				1,355	6	8
„ Library Catalogue Account, Balance at Credit thereof	98	2	9			
„ Life Composition Fund, Balance at Credit thereof.....	778	13	5			
„ New Premises Fund, Balance at Credit thereof	10,420	0	8			
„ Sinking Fund, Balance at Credit thereof	160	0	0			
„ Saxon Snell Prize Fund, Balance at Credit thereof	754	2	3			
				12,210	19	1
„ Balance of Assets over Liabilities				5,932	0	4
				£19,498	6	1

Examined with the Books, Vouchers, and Accounts, and found correct,

26th March 1908.

FUND.

	£	s.	d.
By Balance brought forward from last Account	10,338	19	0
„ Donations	81	1	8
	£10,420	0	8

Further donations have been promised to the amount of £921 4s. 6d.

PRIZE FUND.

	£	s.	d
By Balance brought forward from last Account	732	8	8
„ Interest	21	15	2
	£754	3	10

31st DECEMBER, 1907.

ASSETS.	£	s.	d.	£	s.	d.
By Library and Contents of Museum, Furniture and Publications	1,610	15	2			
„ Subscriptions in Arrear	243	12	0			
„ Sundry Debtors	546	5	3			
„ Cash in hand and on Deposit	1,652	13	8			
				4,053	6	1
„ Investments—						
£7,908 11 1 2½% Consols.	7,672	16	0			
£1,000 0 0 3 % India Stock	1,095	1	0			
£1,000 0 0 3½% „	1,156	6	0			
£5,500 0 0 4 % New Zealand Stock ...	6,098	4	6			
£500 0 0 3½% New South Wales Stock	502	10	0			
£725 7 9 3% Metropolitan Water Board Stock	700	0	0			
Cost	17,224	17	6			
Market Value of these Securities on Dec. 31st, 1907				15,445	0	0
				£19,498	6	1

WOOD, DREW, & Co., Chartered Accountants,
W. COLLINGRIDGE, M.D. } *Auditors*

THOMAS W. CUTLER, *Treasurer.*

REVIEWS OF BOOKS.

School Hygiene.*

This text book is based on lectures delivered to teachers in the West Riding by Dr. Lyster, and contains much valuable information in a readable form. We are not, however, in entire agreement with all the opinions expressed by the writer. Thus it would seem that Dr. Lyster adopts a quotation from the *British Medical Journal*, which implies that personal hygiene should take the place of nature-study in elementary schools. Would it not be better to suggest that nature-study should be used as a means of inculcating the principles of hygiene? We fancy, too, that Dr. Kerr's well-known preference for mechanical ventilation is overstated on page 87, though we cannot verify the quotation as no reference is given; nor do we think that many would agree with Dr. Lyster that unplastered brick walls are suitable for class-rooms. In our experience they are anything but satisfactory.

In future editions of the book, we suggest that more space might well be devoted to the development of the nervous system in relation to educational problems. For this room might perhaps be found by omitting some of the details of school construction, which are somewhat fuller than is necessary for the purposes of school teachers; meanwhile the present edition is a welcome addition to the growing literature of School Hygiene. H. M. R.

The Theory and Practice of Hygiene.†

It would be difficult to recognise in this volume the form and substance of the classical work by the late Dr. Edmund A. Parkes, upon which it is founded, for at the hands of Colonel Notter and Colonel Firth the volume has, during recent years, been subjected to a wide extension of treatment and many fundamental changes. These modifications and expansions are of course essential, if a treatise upon such a progressive science and art as that relating to Public Health is to be kept up to date.

The work has always occupied a foremost place among standard publications upon Hygiene, and the present volume, which has been practically re-written by Colonel Firth, is well designed to maintain that position. Those intimately acquainted with the former edition will recognise that every chapter has been carefully revised and supplemented with new matter; more especially will this be noted in the subjects of Sanitary Legislation and Administration, Water, Food, Habitations, Sewage, Disinfection, Vital Statistics, and Army Sanitation.

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* By Robert A. Lyster, M.B., D.P.H., etc., Medical Officer of Health, and Medical Officer to the Education Committee, Handsworth. 360 pp. Published by the University Tutorial Press, 1908. Price 3/6.

† Notter and Firth. Third Edition. Revised and largely re-written by Lieut.-Colonel R. H. Firth, F.R.C.S. J. and A. Churchill, 1908. 993 pp. Price 21/-.

Alike where new matter has been introduced or old matter modified in treatment, good judgment has been displayed; and the present volume bears testimony to the fact that the theory and practice of Hygiene has been handled by one who has not only an intimate and practical acquaintanceship with the subject in its many bearings, but who also possesses the art of the successful teacher—for it is at once a sound and practical exposition, and a model of clear and orderly treatment.

H. R. K.

MEETINGS HELD.

Sessional Meetings.

Hull, April 4th.—The meeting was held in the Council Chamber, when a discussion on "Diphtheria in Elementary Schools, and its Prevention" was opened by J. Wright Mason, M.B., C.M., D.P.H., M.R.C.S., Medical Officer of Health. In the afternoon visits were made to the Disinfecting Station, Corporation Stables, Destructor, and Cold Stores, and the members were entertained by the Mayor and Mayoress to tea in the Banqueting Room of the Town Hall.

London.—The meeting was held in the Parkes Museum on April 8th, when an adjourned discussion was opened with a paper on "Rivers Pollution, with special reference to the Board proposed by the Royal Commission," by Herbert T. Scoble, P.A.S.I.

Ordinary General Meeting.

The Ordinary General Meeting was held in the Parkes Museum on April 15th, Mr. H. D. Searles-Wood, F.R.I.B.A., presiding.

The following were elected:—

As Vice-Presidents:—

His Excellency the Earl of Aberdeen, P.C., G.C.M.G.
Right Hon. Earl Egerton of Tatton.
Right Hon. Earl Stamford.
Right Hon. Lord Avebury, P.C., D.C.L., F.C.S.
Right Hon. Robert Farquharson, P.C., M.D., LL.D.
Sir Francis Sharp Powell, Bart., M.P.
Sir William Henry Preece, K.C.B., F.R.S., M.Inst.C.E.
Sir Alexander Binnie, M.Inst.C.E.
Sir William Emerson, F.R.I.B.A.
Sir Shirley F. Murphy.
Sir Aston Webb, R.A., F.R.I.B.A.
A. Wynter Blyth, Barrister-at-Law, M.R.C.S., F.I.C., F.C.S.

As New Members of Council:—

Bushell Anningson, M.A., M.D.
J. Spottiswoode Cameron, M.D., B.Sc.
C. H. Cooper, M.Inst.C.E.
A. Wellesley Harris, M.R.C.S., L.S.A., D.P.H.
A. Bostock Hill, M.D., M.Sc., D.P.H.
E. G. Mawbey, M.Inst.C.E.
Col. J. Lane Notter, R.A.M.C., M.A., M.D.
George Reid, M.D., D.P.H.

As Treasurer:—

Thomas W. Cutler, F.R.I.B.A.

As Auditors:—

W. Collingridge, M.A., M.D., LL.M., D.P.H.
Wood, Drew, & Co.

Examinations.

The following Examinations have been held:—

Sanitary Science as applied to Buildings and Public Works.

Southampton, April 3rd and 4th ... 2 candidates; no certificate granted.
Ipswich, April 10th and 11th ..... 2 candidates; no certificate granted.
Liverpool, April 24th and 25th ... 3 candidates; 1 certificate granted.

Qualifying for Membership.

Liverpool, April 24th and 25th ... 1 candidate; no certificate granted.

Inspectors of Nuisances.

Southampton, April 3rd and 4th ... 18 candidates; 6 certificates granted.
Ipswich, April 10th and 11th ..... 13 candidates; 7 certificates granted.
Liverpool, April 24th and 25th ... 35 candidates; 11 certificates granted.

Hygiene in its bearing on School Life.

Southampton, April 3rd and 4th ... 2 candidates; 1 certificate granted.
Liverpool, April 24th and 25th ... 2 candidates; 1 certificate granted.

Candidates who have received Certificates.

Sanitary Science as applied to Buildings and Public Works.

James, Charles Thomas.

Inspectors of Nuisances.

Barke, Kathleen Helen.
Brook, Benjamin George.
Davis, Mary Helen.
Durrant, Walker Edmund.
Figg, Charles Arthur.
Gurney, Malcolm Grace.
Jackman, Henry Charles.
Martin, Mary Sophia.
McCrindell, Janet Edith.
Mercer, John.
Merchant, William George.
Murray, Michael Joseph.
Owen, George Henry.
Penney, Joseph.
Phillips, Joseph Heathfield.
Riding, Harry.
Salmon, Frederick Charles.
Saunders, Stuart William.
Smith, Frederick.
Statham, Arthur Percy.
Thomas, Thomas Tadmar.
Wallis, Fred.
Warren, Arthur Samuel.
Whitehouse, Thomas.

Hygiene in its bearing on School Life.

Smith, Muriel Grimston. | Umfrievelle, Dorothy Joan.

FORTHCOMING MEETINGS.

Examination for Women Health Visitors and School Nurses.

Many Local Authorities have in recent years appointed Health Visitors to carry out sanitary inspection and visiting in their district.

These Health Visitors have proved of great value in the sanitary service, especially in visiting the homes in the poorer districts, and by advising with regard to the home arrangements, and the feeding and care of children, have done much to assist in improving sanitary conditions and reducing infant mortality.

Hitherto they have mostly prepared themselves for their duties by taking the Examination for Inspectors of Nuisances, and although all the subjects of this Examination and the preparation for it are undoubtedly useful to them, the nature of their duties renders it important that they should be more specially qualified in other matters relating to personal hygiene and the care of children, which do not come within the scope of the duties of an Inspector of Nuisances set out by the Local Government Board.

Moreover, as the inspection of school children becomes general, it will probably be found necessary to appoint School Nurses as suggested in a memorandum issued by the Board of Education, whose duties will approximate to those of Health Visitors.

The Council of The Royal Sanitary Institute after careful consideration have therefore decided to establish an Examination for Health Visitors and School Nurses.

The syllabus includes General Structure of the Body, Personal Hygiene, Air, Water, Food, Clothing, The Dwelling, Elements of Home Nursing, Care of Infants and Young Children, Prevention of Communicable Disease, First Aid, Treatment of Injuries, Ailments and Accidents, and Statistics.

Full copies of the syllabus and regulations can be obtained at the office, and will be published in the Supplement to the next Journal.

Sessional Meetings.

Shrewsbury, May 23rd. Discussion on "The Inspection of Dairies and Cowsheds," to be opened by T. W. H. Garstang, M.A., M.R.C.S., D.P.H., Medical Officer of Health, Bucklow R.D. Visit to the Shrewsbury Sewage Farm, and drive to Haughmond Abbey.

London, June 13th, 11 a.m. Discussion on "Pasteurization of Milk," to be opened by Prof. Henry R. Kenwood, M.B., D.P.H., Medical Officer of Health, Stoke Newington. In the afternoon a visit will be made to Sudbury Park Dairy Farm and the Walker Gordon Laboratories, by invitation of Mr. G. Titus Barham.

Coventry, June 20th. Discussion on "Some Aspects of the Housing Problem and Town Planning," to be opened by E. H. Snell, M.D., B.Sc., D.P.H., Medical Officer of Health, and J. E. Swindlehurst, M.Inst.C.E., City Engineer. Visits to places of interest in the City and Kenilworth Castle.

Annual Dinner.

His Grace the Duke of Northumberland, K.G., President of the Institute, has consented to take the chair at the Annual Dinner of the Institute, which will be held on Tuesday, May 12th, at the Langham Hotel.

Examinations.

In Sanitary Science as applied to Buildings and Public Works, for Inspectors qualifying for membership, in Hygiene in its bearing on School Life and for Inspectors of Nuisances.

Liverpool, April 24th and 25th.
Edinburgh, May 8th and 9th.
Leeds, May 15th and 16th.
London, May 22nd and 23rd.
Dublin, June 12th and 13th.
Manchester, June 19th and 20th.
Cardiff, June 26th and 27th.

For Inspectors of Meat and other Foods—
Liverpool, May 1st and 2nd.
London, May 29th and 30th.

Calendar, May and June, 1908.

As far as at present arranged.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

MAY.

1 F. Lecture. Meat Inspectors' Course, at 5.30 p.m.

1 F. Lecture to Sanitary Officers at 7 p.m. The Laws, By-laws, and Regulations affecting the inspection and sale of Meat and other articles of Food, including their preparation and adulteration, by E. Petronell Manby, B.A., M.D., D.P.H., Medical Inspector, L.G.B.

1 F.
2 S. } Examination for Inspectors of Meat and Other Foods, Liverpool.

2 S. Demonstration to Commissioned Officers and Professional Men at 3 p.m.

4 M. Lecture to Sanitary Officers at 7 p.m. Diseased Meat, with a Demonstration of Morbid Specimens collected from Meat Markets, by James King, M.R.C.V.S.

5 T. Inspection and Demonstration in Fish Inspection at Billingsgate Market at 10 a.m., conducted by J. Roberts, Chief Fish Inspector, Fishmongers' Company.

5 T. Lecture to Commissioned Officers and Professional Men at 5.30 p.m. on Meat Inspection, by James King, M.R.C.V.S.

6 W. Inspection and Demonstration at Harrison & Barber's Knackers' Yard, Winthrop Street, Whitechapel, E., at 3 p.m. Conducted by R. Glover, F.R.C.V.S.

8 F. Lecture to Commissioned Officers and Professional Men at 5.30 p.m. The Appearance and Character of Fresh Meat, Organs, Fat, Blood, Fish, Poultry, Milk, Fruit, Vegetables, and other food, and the conditions rendering them, or preparations of them, fit or unfit for human consumption. Preserving and Storing Meat and other foods, by E. Petronell Manby, B.A., M.D., D.P.H.

8 F. Lecture—Meat Inspectors' Course, at 6.30 p.m.

8 F.
9 S. } Examinations—Edinburgh.

9 S. Demonstration to Commissioned Officers and Professional Men at 3 p.m.

11 M. Lecture to Commissioned Officers and Professional Men, at 5 p.m., on Tinned and Potted Food, by Prof. H. R. Kenwood, M.B., D.P.H.

12 T. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., on Meat Inspection by James King, M.R.C.V.S.

12 T. **Annual Dinner of the Institute,** at the Langham Hotel, the President, His Grace the Duke of Northumberland, K.G., in the chair.

13 W Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., on Meat Inspection by James King, M.R.C.V.S.

14 Th. Lecture to Commissioned Officers and Professional Men, at 5 p.m., on Milk, Butter, Cheese, etc., by Prof. H. R. Kenwood, M.B., D.P.H.

15 F. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., on Meat Inspection by James King, M.R.C.V.S.

15 F.
16 S. } Examinations—Leeds.

16 S. Demonstration—Meat Inspectors' Course, at 2 p.m.

16 S. Demonstration to Commissioned Officers and Professional Men, at 3 p.m.

18 M. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Fish, Eggs, Tea, Coffee, Cocoa, Chocolate, Lime Juice, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

19 T. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Wheat, Rice, Arrowroot, and other Grains, Potatoes, Flour, Bread, Biscuits, Sugars, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

20 W. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Succulent Vegetables and Fruits, Jams; the Condiments—Vinegar, Pepper, Mustard; Prepared, Concentrated, and Preserved Foods, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

21 Th. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Alcoholic Beverages—Beer, Wines, Whisky, Brandy, etc., by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

22 F. Demonstration to Commissioned Officers and Professional Men at a Factory for Preparation of Concentrated and Preserved Foods.

22 F. Lecture—Meat Inspectors' Course, at 6.30 p.m.

22 F.
23 S. } Examinations—London.

23 S. **Sessional Meeting,** SHREWSBURY, at 11 a.m. Discussion on "Inspection of Dairies and Cowsheds," to be opened by **T. W. H. Garstang,** M.A., M.R.C.S., D.P.H., Medical Officer of Health, Bucklow R.D. Visit will be made to the Shrewsbury Sewage Farm, and drive to Haughmond Abbey.

23 S. Demonstration to Commissioned Officers and Professional Men, at 3 p.m.

29 F. } Examination for Inspectors of Meat and other Foods, London.
30 S. }

JUNE.

12 F. } Examinations—Dublin.
13 S. }

13 S. **Sessional Meeting,** LONDON, at 11 a.m. Discussion on "Pasteurization of Milk," to be opened by Prof. R. H. Kenwood, M.B., D.P.H., Medical Officer of Health, Stoke Newington. In the afternoon a visit will be made to the Sudbury Park Dairy Farm and the Walker Gordon Laboratories by invitation of Mr. G. Titus Barham.

19 F. } Examinations—Manchester.
20 S. }

20 S. **Sessional Meeting,** COVENTRY, at 11 a.m. Discussion on "Some Aspects of the Housing Problem and Town Planning," to be opened by E. H. Snell, M.D., B.SC., D.P.H., Medical Officer of Health, and J. E. Swindlehurst, M.INST.C.E., City Engineer. Visits will be made to places of interest in the City and Kenilworth Castle.

26 F. } Examinations—Cardiff.
27 S. }

JULY.

13–22. **Congress and Exhibition, Cardiff.**

LIST OF MEMBERS AND ASSOCIATES

ELECTED APRIL, 1908.

MEMBERS.

* Marked thus have passed the Examination in Sanitary Science as applied to Buildings and Public Works.

† Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.

Reg. No.	Date of Election.	
[illegible]	1908. Apr.	ARNOLD, Miles B., M.D., CH.B.MANC., D.P.H.CAMB., *Public Health Office, Blackburn.*
[illegible]	1908. Apr.	ATKINSON, Hon. John Mitford, M.B., D.P.H.CAMB., *Principal Civil Medical Officer, Hong Kong, China.*
[illegible]	1908. Apr.	†BARRALET, Thomas C., *Surveyor, Godstone Rural District Council, New Oxted, Surrey.*
[illegible]	1908. Apr.	BORTHWICK, Thomas, M.D., *Medical Officer of Health, Adelaide, South Australia.*
[illegible]	1908. Apr.	BRUCE, Peter Henderson, M.A., M.D., L.R.C.P.&S.EDIN. *Chief Medical Officer, Department of Interior, Ottawa, Canada.*
[illegible]	1908. Apr.	FAIRLEY, William, F.G.S., ASSOC.M.INST.C.E., 69, *Victoria Street, S.W.*
[illegible]	1908. Apr.	*HAYNES, Charles Thomas, *Chief Sanitary Inspector, Auckland, New Zealand.*
[illegible]	1908. Apr.	HIGGINBOTHAM, Frederick W., M.INST.C.E.I., 9, *Lower Sackville Street, Dublin.*
[illegible]	1908. Apr.	JONES, Edward William Taylor, F.I.C., *Public Analyst*, 10, *Victoria Street, Wolverhampton.*

2103 1908. Apr. McPHAIL, James, M.R.C.V.S. 299, *Anlaby Road, Hull.*

2111 1908. Apr. OWENS, Robert Black, B.A., B.E., *Provincial Sanitary Engineer, Edmonton, Alberta, Canada.*

2112 1908. Apr. STEPHENS, John Kyle, F.S.I., 13, *Donegall Square North, Belfast.*

2113 1908. Apr. STODDART, Frederick Wallis, F.I.C., F.C.S., *Public Analyst, Western Counties Laboratory, Bristol.*

2114 1908. Apr. STOWELL, Hugh, ASSOC.M.INST.C.E., *Mersey and Irwell Joint Committee,* 44, *Mosley Street, Manchester.*

2115 1908. Apr. TATE, John, M.R.C.S., L.R.C.P., D.P.H.LOND., 26, *Freegrove Road, Holloway, N.*

2116 1908. Apr. THOMPSON, George Rudd, F.I.C., F.C.S., *Public Analyst,* 69, *Dock Street, Newport, Mon.*

ASSOCIATES.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.
M Marked thus have passed the Examination of the Institute for Inspectors of Meat and Other Foods.
S Marked thus have passed the Examination of the Institute in Hygiene in its bearing on School Life.

Neg. No. Date of Election.

1106 1908. Apr. TURNER, Harold George, F.I.S.E., *Assistant Engineer and Surveyor, U.D.C. Offices, Surbiton, Surrey.*

1107 1908. Apr. ‡BEVAN, Walter William, *Mill House, Mapledurham, Reading.*

1108 1908. Apr. *M BRIDEL, George James, 32, *Bardolph Road, Tufnell Park, N.*

1109 1908. Apr. CAREY, Miss M., *Westminster City Hall, S.W. (Cert. S.I.E.B.)*

1110 1908. Apr. ‡CLARKE, Charles, 3, *Spring Mill, Ogden, Newhey, near Rochdale.*

1111 1908. Apr. ‡DAVIES, Philip Isaac, 32, *High St., Ebbw Vale, Mon.*

1112 1908. Apr. ‡EVANS, Evan Caron, *Penddol, Tregaron, Cardigan.*

1113 1908. Apr. ‡HAWKINS, Edward T. H., *Brockley, near Bristol.*

1114 1908. Apr. ‡HUNT, Miss Martha Alice, 38, *Fitzwarren Street, Pendleton, Manchester.*

1115 1908. Apr. ‡JACKSON, Percy, 332, *Maston Lane, Maston, Manchester.*

1116 1908. Apr. ‡KNEWSTUBB, Alfred, *Long Marton, Carlisle.*

1117 1908. Apr. ‡LYON, William Ernest, *Laurel Grange, Earlestown, Newton-le-Willows.*

1118 1908. Apr. *S* NORRIS, Miss Daisy Flora, *Lake View, Darwen.*

1119 1908. Apr. ‡NORRIS, William Astley, *Surveyor and Inspector, Swaffham, Norfolk.*

1120 1908. Apr. ‡LEE, George Alfred, 15, *Symons Street, Fountain Road, Hull.*

1121 1908. Apr. ‡RANDALL, George Walker, 27, *Ure Bank, Ripon Yorks.*

1908. Apr. ‡Radford, Miss Lilian, *Sutton Lane Ends, Macclesfield.*

1908. Apr. Saul, Joseph Duncan, 48, *Ingham Road, West Hampstead, N.W. (Cert. S.I.E.B.)*

1908. Apr. ‡Shaw, George Atha, 38, *Park Gate, Berry Brow, Huddersfield.*

1908. Apr. ‡Smith, George, *Fairhaven, James Street, Swadlincote, near Burton-on-Trent.*

1908. Apr. ‡Tolcher, William Henry, *Lower Park View, Ashburton, South Devon.*

1908. Apr. ‡Whorwell, John George Bromley, 7, *Beach Street, Dover.*

1908. Apr. ‡Wilson, Miss Marion, C., *London Place, Gourock, N.B.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY.*

*** *For publications of Societies and Institutions, etc., see under "Academies."*

ACADEMY (American).

Washington. *American Institute of Architects.* Proceedings of the Forty-first Annual Convention, 1907. 176 pp., 4to. Providence, 1907. *The Institute.*

ACADEMIES (British).

London. *Civil and Mechanical Engineers' Society.* Rules and List of Members, March, 1908. 12 pp., 8vo. London, 1908. *The Society.*

——— *Association of Water Engineers.* Transactions, Vol. XII., with Contents and Subject Index of Vols. I. XII. 1907. 434 pp., 8vo. London, 1908. *The Association.*

——— *Garden City Association.* Report of Conference on "Town Planning in Theory and Practice," held at the Guildhall, London, on October 25th, 1907, under the presidency of the Lord Mayor of London. 72 pp., 8vo. London, 1908. *The Association.*

——— *Society of Engineers.* Rules and By-Laws, List of Members, Report of Council, and Statement of Accounts, 1907. 41 pp., 8vo. London, 1908. *The Society.*

——— *Surveyors' Institution.* Transactions, Session 1907–1908, Vol. XL., Parts VII. and VIII. 91 pp., 8vo. London, 1908. *The Institution.*

Benians, *E. A., M.A., and* **Knight,** *T. H., M.A.* Historical Atlas, with Chronological Notes. 89 pp., 4to. London, 1908. *G. Gill & Sons, Ltd. (publishers).*

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* Members or Associates wishing to file or catalogue these Titles can, on application, be supplied with excerpt copies for this purpose.

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Tyne Port, 1907 .. .. .. *W. E. Harker, M.D., D.Hy.*

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Wednesbury, for Year ended Dec. 31st, 1907 .. .. .. *W. C. Garman, M.D.*

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CARDIFF.

The place of meeting for the Congress and Exhibition of the Institute, 1908.

To its geographical position Cardiff owes no small proportion of its prosperity. Behind it is the great South Wales coalfield, which, in spite of the tremendous vigour with which it is worked, must continue for ages to come to supply Britain and the world with no small proportion of their fuel.

Cardiff lies at the mouths of three rivers—the Rumney, Taff, and Ely; and from its natural position and other advantages has secured a coal export trade unequalled by any other port in the world. The town in general is built on low-lying land which stretches eastwards with little to break the monotony along the course of the Severn as far as Chepstow. Westward, however, the flat is bounded by a ridge which terminates in the bold promontory of Penarth Head. The Vale of Glamorgan lies further west, and is, for the most part, a gently undulating plain from the sea to the margin of the coal basin.

It is a Parliamentary, municipal, and county borough, the capital of Glamorgan; it is in the hundred of Kibbor, in the petty and quarter sessional divisions of Cardiff, the union and county court district of the same, and the diocese and archdeaconry of Llandaff. The advance made by the town and port during the past century is little short of marvellous. At the commencement of that period the population was only a thousand or thereabouts, but it is now close upon 200,000. Nor has Cardiff grown at the expense of either health or beauty. Thanks to the enlightened policy of its citizens, Cardiff is one of the healthiest of the commercial centres of the kingdom. Visitors admire the docks and shipping; but, as they mostly entertain odd misconceptions of the town, they are agreeably surprised and delighted at its broad, busy streets, its fine buildings, its noble castle, its pleasant parks and public gardens, its glorious sweep of river, and the general air of *rus in urbe* that pervades this most cosmopolitan of towns.

Cardiff is in the very centre, not only of the most populous part of Wales, but also of the part which shows the most rapid increase in its population. From the census returns it is apparent that within a radius of 40 miles of Cardiff is collected more than half the population of the entire Principality.

Although it is generally called a modern town, its origin dates back to the time of the Roman invasion, and it is believed by some that in the Welsh name Caer Dydd (the camp of Didius) we have a trace of Aulus Didius, who, in the first century, planted the standard of Rome at the mouth of the Taff.

On the withdrawal of the Roman Legions, Cardiff reverted to the rule of the native chieftains, and became part of the great kingdom of Morganwg; and for 600 years (from the end of the fifth to the end of the eleventh century) the place remained beneath the sway of a succession of Welsh princes, fiercely contesting the incursions of the Saxons and Danes, as their fathers had resisted the invasions of the Romans.

The commercial importance of Cardiff is due so much to its docks that a brief mention should be made of the most important features.

About seventy years ago Lord Bute enlarged the docks considerably as a private venture.

The actual cost of the work was £350,000: £220,000 in hard cash and the remainder in limestone and timber obtained from Lord Bute's estate.

In October, 1839, the new dock was opened, and within twelve years of the opening the trade had increased so considerably that it was decided to enlarge the docks still further, and the present Bute east dock was constructed.

The Roath Dock, opened in August, 1887, has a water area of about 33 acres, and is upwards of 2,400 feet long and 600 feet wide. The bottom of the dock is 43 ft. 6 in. below the level of the coping, and the depth of water ranges from 36 ft. to 26 ft., according to the tide.

Cardiff is in respect of foreign clearances the first port in the world, not excepting even New York, London, and Liverpool, as is shown by the following official statistics for 1903:—

		Tons Register.
Cardiff	...	8,190,249
London	...	8,104,890
Liverpool	...	6,682,568

Cardiff Castle occupies the site of the ancient British fortifications, and the place was the first "iter" from the great station at Caerleon on the Via Julia Maritima.

The late Marquess devoted great thought and large sums of money to the restoration of the castle, and its present appearance from the town is largely due to the restorations carried out for the Marquess by Mr. Burgess, R.A.

Among the public Buildings may be mentioned the old Town Hall in St. Mary's Street, and the new Municipal Buildings and the Law Courts in Cathays Park, where the meetings of the Congress are to be held.

Places interesting to visit in the neighbourhood: Barry Docks, Caerphilly and its Castle, Neath and its Abbey, Coity Castle, and Tintern Abbey.

A fuller account of Cardiff will be published in the Guide Book which is being prepared by the Local Committee in connection with the Congress.

From "Guide to Cardiff."—"Western Mail, Ltd."

CARDIFF CASTLE.

From "Guide to Cardiff."—"Western Mail, Ltd."

OLD TOWN HALL.

From "Guide to Cardiff."—'Western Mail, Ltd.'

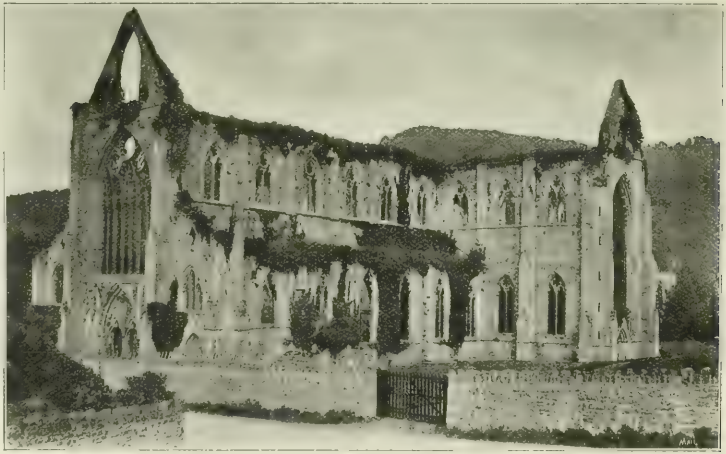
THE NEW CITY HALL, CATHAYS PARK.

From "Guide to Cardiff."—"Western Mail, Ltd."

THE NEW LAW COURTS, CATHAYS PARK.

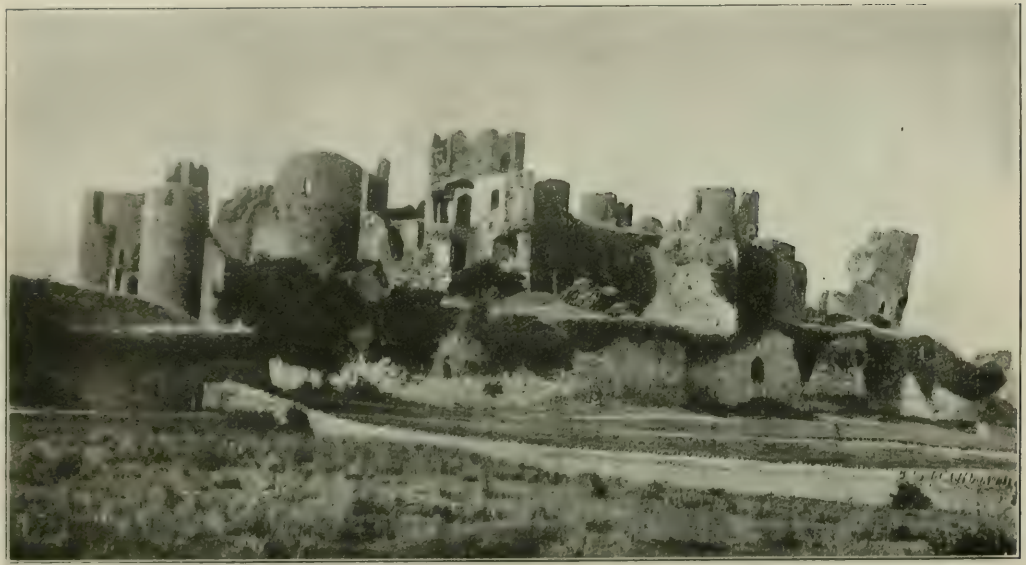
From "Guide to Cardiff."—"Western Mail, Ltd."

CARDIFF DOCKS.



From "Guide to Cardiff."—"Western Mail, Ltd."

TINTERN ABBEY.



From "Guide to Cardiff."—Western Mail, Ltd.

CAERPHILLY CASTLE.

SANITARY PROGRESS IN CARDIFF.

By E. WALFORD, M.D., D.P.H., Medical Officer of Health, Cardiff.

THE Corporation of the City of Cardiff is responsible for the sanitary administration of the town and port. Nominally there are two separate bodies, the Urban Sanitary Authority having jurisdiction over the whole of the city, and the Port Sanitary Authority over a part of the customs port of Cardiff, extending from the mouth of the River Rumney to the common boundary of the parishes of Sully and Lavernock; the district extending three miles seaward from low-water mark, and including all docks, rivers, canals, etc., within that limit.

In both cases, however, the City Council acts as the Sanitary Authority, and delegates most of its executive power to the Health and Port Sanitary Committee. The sanitary departments of both authorities are under the direction of the medical officer of health, who has well-arranged offices belonging to the Urban Authority in the new City Hall, and in Bute Street, near the docks, in connection with the Port Sanitary Authority. Both departments have now an efficient and well-qualified staff of inspectors; those belonging to the Urban District holding the certificate of The Royal Sanitary Institute, or some similar qualifications, whilst those of the Port District hold in addition certificates showing experience of shipping matters.

The staff of inspectors acting for the town comprises an inspector of nuisances, who is chief inspector, five assistant district inspectors, six special inspectors in connection with infectious diseases, the inspection of lodging houses, factories and workshops, and meat and other foods, three disinfectors, three clerks, and two women inspectors. The staff in the port district comprises a chief inspector, five assistant inspectors, and one clerk.

The sanitary supervision of schools under the control of the Cardiff Education Authority, and the medical inspection of school children in the elementary schools, are under the direction of the medical officer of health, who has two medical assistants, one male and one female, in connection with this work which is co-ordinated with the general public health work in the department.

A very complete isolation hospital has been established by the sanitary authority in the western district of the town, capable of containing about 116 patients suffering from the ordinary infectious diseases. In addition to this there is a separate small-pox hospital with 50 beds.

The Port Sanitary Authority also possesses a special hospital on the Flat Holme Island for the reception of cases of cholera or plague. On this island is also situated a small crematorium for the destruction of the bodies of persons dying from these diseases.

A disinfecting station has now been established upon land belonging to

the corporation in Sloper Road, to which infected articles are removed and submitted to disinfection in a Washington Lyon's Steam Disinfecting Apparatus. This work is carried out free of charge in all cases, where a notification of infectious diseases has been received by the medical officer of health.

A very complete system of food inspection has been adopted, a work which is greatly facilitated by the absence of private slaughter-houses in the city, all cattle and animals being slaughtered in the public slaughter-houses belonging to the Corporation. A qualified veterinary surgeon acts as chief meat inspector, with six inspectors under him. The vigilance exercised in this direction may be judged to some extent by the quantity of meat condemned, which amounts on the average to about 50,000 lbs. in weight annually. A great deal of this is surrendered voluntarily by the owner, not having been exposed for sale.

Inspection of the houses in the district is carried out systematically by the district inspectors, under the direction of the chief inspector and medical officer of health. There is in Cardiff comparatively little insanitary property, and no large insanitary areas have been condemned under the Housing of the Working Classes Act. In the centre of the town, however, several small courts have been dealt with under this Act, the houses in which have been closed and demolished, being unfit for habitation.

A well-equipped public health laboratory has been established in connection with the medical officer of health's department, in which bacteriological and chemical work connected with public health administration is carried out. This laboratory belongs jointly to the Cardiff Corporation and to the Glamorgan County Council, and the medical officers of health act as directors on behalf of their respective authorities. The staff consists of Mr. H. A. Schölberg, M.B., D.P.H., Bacteriologist, and Mr. J. H. Sugden, M.Sc., F.I.C., Chemist, with laboratory assistants. The work carried out in this laboratory has been of the utmost value, especially in the examination of food, water, sewage effluents, air, and pathological specimens. It is utilised also for teaching purposes, and forms an important part of the equipment of the public health department of the medical faculty of the University College of South Wales and Monmouthshire, in connection with which there is a post-graduate course for medical men preparing for the examinations for the several diplomas in public health.

The rapid growth of the town is shown in the following figures taken from the decennial census returns of the Registrar-General :—

Year.		Population.	Year.		Population.
1801	...	1,870	1861	...	32,054
1811	...	2,577	1871	...	39,536
1821	...	3,521	1881	...	85,371
1831	...	6,187	1891	...	128,915
1841	...	10,077	1901	...	164,333
1851	...	18,351			

The estimated population in each year since the last census is as follows:—

Year.	Estimated Population.	Year.	Estimated Population.
1902 ...	168,909	1905 ...	180,054
1903 ...	172,598	1906 ...	183,823
1904 ...	176,313	1907 ...	187,620

Some idea of the improvement which has taken place in recent years in the public health may be obtained by a glance at the vital statistics of former periods as compared with those of recent date. The earliest period for which statistics are available is the year 1847. The returns for the years 1847, 1848, and 1849 show that in each of these years the deaths exceeded the births.

A death-rate of about 48 and a birth-rate of 25 per 1,000 of the population seems to have awakened the sanitary conscience of those in authority, as shortly after this period attempts at reform commenced. The reduction in the general death-rate since the year 1852 is shewn in the following figures:—

Decennial Periods.	Death-rate per 1,000. All Causes.	Zymotic Diseases.
1852–61	29·2	8·5
1862–71	24·2	4·6
1872–81	20·0	3·2
1882–91	21·6	3·3
1892–1901	18·0	2·3

The above figures indicate a reduction in the death-rate of 38 per cent., as compared with a reduction of 23 per cent. in the whole of England and Wales during the same period.

The following table shows the death-rate in Cardiff from all causes and from several diseases during the decennial periods 1881–90, as compared with that of 1896–1905:—

Annual Death-rates per 1,000.

	1881–90.	1896–1905.
All causes	20·70 ...	16·20
Smallpox	0·03 ...	0·01
Measles	0·66 ...	0·42
Scarlet fever	0·41 ...	0·12
Diphtheria	0·20 ...	0·43
Enteric fever	0·33 ...	0·09
Diarrhœa	0·93 ...	0·67
Deaths under 1 year per 1,000 births ...	165 ...	148

Since the year 1905 the death-rate has been still further reduced as follows:—1906, 14·2; and 1907, 15·0 per 1,000.

The construction and recent extensions of a very complete system of sewerage carried out by the Corporation, under the able direction of Mr. W. Harpur, M.I.C.E., the City Engineer, the regular cleansing and scavenging of the streets, and the frequent removal of house refuse, have all contributed towards the improvement in the public health. But perhaps the most important factor in this direction has been the developments which have taken place in the undertakings for the supply of a pure soft water to the district. The far-sighted policy of the Corporation in obtaining Parliamentary powers, and in carrying out extensive works under these powers, and under the direction of the distinguished engineers, Messrs. J. H. B. Williams, M.I.C.E., and C. H. Priestley, M.I.C.E., has been amply rewarded by the improvement in the health of the population. Asiatic cholera no longer figures at all in the mortality returns, and enteric fever, formerly so prevalent, has been reduced in amount to such an extent that the rate of mortality is now one of the lowest amongst the towns of England and Wales. Both these diseases are usually associated with the consumption of impure water.

Steps are being taken with a view of reducing the mortality from pulmonary consumption. It is now universally acknowledged that this disease is due to specific infection, and that conditions of overcrowding and bad ventilation are largely responsible for its spread amongst the community. The preventive measures consist, therefore, in ameliorating these conditions as far as possible, and in educating the public in the best methods of preventing the development and the spread of the disease. In this connection the assistance of the lady health visitors attached to the staff of the medical officer of health is of great value. The services of these ladies are also utilised in giving instruction to mothers in feeding and rearing of infants, and in promoting domestic and school hygiene.

The close association between the health of a community and the prevalent climatic and meteorological conditions to which such community are subject is sufficiently obvious. A new departure has therefore been possible, with the help of the Water-works Department of the Corporation, who have permitted the use of a suitable site for the installation of a very complete Meteorological Station near the Water Reservoir at Penylan. The instruments now in use consist of a maximum thermometer, a minimum thermometer, and wet and dry bulb thermometers (hygrometer), in a Stevenson screen, a grass minimum thermometer, a solar radiation thermometer, earth thermometers (1 ft. and 4 ft.), a rain gauge, a sunshine recorder, a Kew barometer, and a wind vane. This station is placed under the supervision of the medical officer of health. The readings are taken at 9 a.m. and 9 p.m. daily, copies of which are forwarded to the local newspapers, and to the Meteorological Office, London.

THE ROYAL SANITARY INSTITUTE.

REVIEWS OF BOOKS.

The Value of Pure Water.*

This little book is a revised reprint of a paper originally published among the Biological Studies of the pupils of William Thompson Sedgwick, the author being one of the most distinguished of the modern American workers in the application of microscopy and biology to the subject of water purification. It is now nearly ten years ago since the author, in his standard text-book on the microscopy of drinking-water, showed how important a careful microscopic examination of water supplies was, and that it afforded a means of diagnosis in questions of lead poisoning, iron rusting, unpleasant odours, and incrustations in water pipes; and also dealt with the purification effected by storage, as well as many other problems of a practical character upon which the water expert is expected to report and advise. As biologist at the Boston Waterworks, and later as Director of the Mount Prospect Water Laboratory at Brooklyn, the author had had exceptional opportunities of studying the subject in a practical way, and has attempted in the present volume to express arithmetically the value of the sanitary qualities, the attractiveness, the hardness and temperature of a water supply to the community. Thus, for example, he contends and demonstrates that the purification of a polluted water is a sort of life insurance for the people, the value of which is ten cents per capita for each unit decrease in the typhoid fever death-rate per 100,000. The book must be read, however, to follow the arguments of the author, when the reader will not fail to appreciate the valuable suggestions made. All those who are anxious to bring about an improvement in the purity of a water supply will find examples of the way in which a given change towards purity can be estimated in dollars or pounds, shillings and pence, which after all must be the final basis of all practical sanitation. How often the advice of the expert is not followed because he is unable to make the sanitary committee appreciate the commercial value of the improvement to the community it is impossible to gauge, but we feel sure that in a great number of cases the laxity on the part of authorities entrusted with spending the ratepayers' money in improvements in water sanitation is due just to this want of knowledge, which Mr. Whipple in his book supplies. Not only in sanitation, where the insurance based on the mortality-rate can be expressed in monetary value, but in industrial work equally satisfactory figures can be put forward. Thus, for example, the financial loss from the use of hard boiler-waters in the case of the Chicago and North-Western Railway is expressed in regard to waste of coal as 1·2 pounds per 100 "ton-miles," which at $3 per ton for 3,000 million ton-miles equals $30,000 per annum, so that there is a possible saving in assignment of engines equal to $5,000 in the same period, which, together with cost of labour and incident materials, makes a total saving to the road from all causes of $75,000, attainable by using a better water.

The statistical or monetary method, however, does not complete the advan-

* The Value of Pure Water, by G. C. Whipple. Wiley & Sons, New York; Chapman & Hall, London. 1907. Price 4s.

tages, as even in the question of water softening for engine work, the American Committee on Water Service show that besides the economic benefit, there arises a "better feeling among the men, due to fewer failures and shorter time on the road," which cannot be expressed in terms of the almighty dollar, until an American Karl Pearson arises with a calculus capable of integrating the mental and psychological attitude of engine drivers, and of equating their feelings in monetary terms. S. R.

ARTICLES RELATING TO PUBLIC HEALTH,*

Appearing in the chief British and Foreign Journals and Transactions.

Abstracts of Titles classified in this List under the following headings:—

Science in Relation to Hygiene and Preventive Medicine.
Hygiene of Special Classes, Trades, and Professions; and Municipal Administration.
Building Materials, Construction, and Machinery.
Water Supply, Sewerage, and Refuse Disposal.
Heating, Lighting, and Ventilating.
Personal and Domestic Hygiene.

The articles referred to in this list are as far as possible collected and filed in the Library of the Institute for the use of the Members and Associates.

Science in Relation to Hygiene and Preventive Medicine.

"Engineering Record." The Sanitary Campaign in California. 11th April, 1908, p. 499.

The transmission of bubonic plague by rats having been determined, the efforts to destroy them by poisoning are described.

Hygiene of Special Classes, Trades, and Professions; and Municipal Administration.

Burton, William. The Hygiene of the Pottery Trade. *Journal of Society of Arts*, Vol. LVI., No. 2,888, 1908, pp. 494–509.

Chief danger, dust (1) mixed mineral dust: (2) dust of glazes containing lead. Of 73,000 persons employed, only 26,000 exposed to dust danger—19,000 to (1), and less than 7,000 to (2). Works are of very different kinds, and rules for some would not do for others. Describes methods of dealing with mixed mineral dust in various processes. Deals with ventilation. In regard to Plumbism, in the years 1896–1906, the number of workers exposed to risk has somewhat increased, but the number of cases has decreased very greatly. Lead enters the body by nose or mouth, not by skin. In the years mentioned the attack-rate in all the various classes of workers has decreased greatly (tables given), owing to greater care and cleanliness and to monthly medical examination. Believes that by continued care the use of lead may be safely continued.

British Association. Report of Committee on the Conditions of Health Essential to the carrying on of the Work of Instruction in Schools. *Rept. for 1907.* 1908, pp. 421-2.

Children's playtime and leisure; advocates more play. Ventilation of school buildings.

* Members or Associates wishing to file or catalogue these Titles can, on application, be supplied with excerpt copies for this purpose.

Building Materials, Construction and Machinery.

NEPPE, B. The Cause of Poisoning by Arsenical Wall Papers. *Scienza Practica*, I., p. 82.

Cases of poisoning are not due, as is usually thought, to the dry dust given off by the paper, but to a volatile organic arsenic compound produced in the presence of moisture by the action of certain moulds on the paper and the paste by which it is attached to the wall.

Water Supply, Sewerage, and Refuse Disposal.

FOWLER, G. J., EVANS, S., and ODDIE, A. C. Some Applications of the "Clarification Test" to Sewage and Effluents. *Journ. Soc. Chem. Industry*, 16th March, 1908, p. 205.

Description of a new test for colloids and crystalloids for use in routine sewage analysis. Studies of the course of anaerobic and aerobic decomposition of sewage.

HATTON, T. C. A Sewage Disposal Plant for a large Hotel at Bedford, Pa. *Engineering Record*, 28th March, 1908, p. 376.

Description of screen chamber, contact beds, sludge bed, etc., of sewage works for 400 guests and 100 employees.

JOHNSTON, J. H. The Rôle of Colloids in the Purification of Sewage. *Zeitschrift für Chemie und Industrie der Kolloide*, March, 1908.

An explanation of the part played by colloids in the purification of sewage by natural and artificial processes.

MAPLETON, H. B. Annual Report, 1907, of the Medical Officer of Health for Newton Abbot.

Includes a consideration of the question of the interceptor trap, and expresses the opinion that in compact towns where ventilation of sewers is in vogue the trap is of little value, but in districts where there is much space between dwelling and sewer the trap is desirable.

MEETINGS HELD.

INSTITUTE DINNER.

The Institute Dinner was held at the Langham Hotel, on Tuesday, May 12th, 1908, His Grace the Duke of Northumberland, K.G., President, in the Chair. Eighty-four members and guests were present, among whom were:—The Right Hon. Earl of Plymouth, P.C., C.B.; Lord Robert Cecil, K.C., M.P.; Sir R. Douglas Powell, K.C.V.O., President, Royal College of Physicians; Sir Francis Sharp Powell, Bart., M.P., Vice-President; Sir Mark Mc J. Stewart, Bart.; The Right Hon. the Lord Mayor of Cardiff; Sir Alexander Binnie, Vice-President; Sir William Emerson, Vice-President; Sir Shirley F. Murphy, Vice-President; Sir Henry Tanner, I.S.O.; Surg.-Gen. A. M. Branfoot, C.I.E., President, Medical Board, India Office; The Hon. Mr. Justice Grantham:

Colonel G. O. Welch, Assistant Director of Transport, Headquarters Staff; Colonel G. K. Scott-Moncrieff, C.I.E.; Chairman, Cattle Markets Committee, City of London (R. Dyas); Chairman, Sanitary Committee, Wimbledon (Dr. Ford); President, Association of Municipal and County Engineers (J. A. Brodie); A. Newsholme, M.D., F.R.C.P., Chief Medical Officer, Local Government Board; G. W. Wilcocks, Chief Engineering Inspector, Local Government Board; Chairman, Sanitary Inspectors Association (G. H. Anderson); H. D. Searles Wood, F.R.I.B.A., Chairman; Colonel J. Lane Notter, R.A.M.C., Deputy Chairman; A. Wynter Blyth, M.R.C.S., Registrar and Vice-President; T. W. Cutler, F.R.I.B.A., Treasurer; Henry Adams, M.Inst.C.E., Chairman, Board of Examiners; Louis C. Parkes, M.D., D.P.H., Chairman, Museum Committee; and the Council of the Institute.

The President proposed the toast of "The King, and that of Queen Alexandra, the Prince and Princess of Wales, and other members of the Royal Family."

The Earl of Plymouth, P.C., C.B., President of the Institute's Congress at Cardiff, 1908, in proposing the toast of "The Army, Navy, and Territorial Forces," said: I do not think there can be any one in this room who if he had his desire would not wish to see the two Services of the State, the Army and the Navy, entirely separated from party politics, and those political controversies which rage round the yearly Budget-making. The expenditure on the Navy and Army ought to be considered a national insurance such as enables us to administer a vast Empire and fulfil our obligations—obligations which are incidental to a great governing power in freedom and security. Gentlemen, the unfortunate disasters which have lately happened to more than one of His Majesty's Ships are almost inseparable from the nature of the Service, and from the fact that the Navy in this country is always ready to undertake the discharge of all those duties which would have to be undertaken in time of war. Those who have unfortunately suffered in those disasters and catastrophes must be considered as much heroes as if they fell in actual warfare. But, gentlemen, apart from the actual condition of the Navy and the Army, apart from whether they be large or small in numbers, a most essential condition of their efficiency in time of war is that they should have a proper medical service, and that they should be in touch with all those who are interested in sanitary questions in this country. Nothing indeed can be more important to the Army than a medical service, trained and fully equipped, so that those ravages from disease which are worse than the danger from an enemy's bullets should be met at the outset, and that so an enormous number of lives that belong to the country should be saved for the service of the country. In so far as those duties particularly affect us this evening, it is gratifying to think that prominent members of those Medical Services connected with the two great Services of the State, which are the subjects of this toast, have also been prominent members of The Royal Sanitary Institute. I have the pleasure and the honour of coupling with this toast the name of Surgeon-General Branfoot, C.I.E., who is President of the Medical Board of the India Office, and he is one

among many distinguished persons connected with the Navy and Army who have been connected with this Institution.

The toast was responded to by Surgeon-General Branfoot, C.I.E.

The Hon. Mr. Justice Grantham proposed the toast of "The Houses of Parliament," which was responded to by Lord Robert Cecil, K.C., M.P.

The President, in proposing the toast of the evening, "The Royal Sanitary Institute," said that the object of The Royal Sanitary Institute is the dissemination of sanitary knowledge.

The Institute numbers over 3,700 members and Associates. The income last year (1907) was £7,857 3s. 8d., and its capital is about £17,000. The meetings at or connected with the Institute during last year, numbered 579, and were attended by about 22,000 people.

Recently the Council had established a new examination for Women Health Visitors and School Nurses, whose duties differed rather from those of the Sanitary Inspector, and the examination includes subjects relating to the care of children and personal hygiene, as well as matters relating to the sanitation and healthiness of the dwelling. The extension of the work of the Institute in the Colonies was just now attracting special attention. In Hong Kong the Governor and Lady Lugard distributed the certificates granted by the Institute, and made very complimentary reference to its work; and the Indian Government had suggested that courses of training for sanitary inspectors should be established there, based on the syllabus of The Royal Sanitary Institute. If they could spread sanitary knowledge amongst the natives of that country, they might perhaps hope to do something also to withstand those hideous epidemics which swept through the country from time to time.

New Premises.

There was good reason to hope that the efforts that the Council had been making to secure new premises, were coming to a successful conclusion. Subject to the necessary settlement of legal questions involved, the Council had come to an arrangement to secure very suitable premises close to Victoria Station, which would give more than double the accommodation of the present premises, besides being more conveniently arranged. This would, it was hoped, give a valuable stimulus to the work which the Institute was carrying on, and although a good deal of the money required had already been accumulated, the expenses of adaptation and equipment would be necessarily heavy, and a special effort would be requisite on the part of the members to meet this. He was pleased to be able to announce that Lady Douglas Galton, whose name they all know, and who had shown the keenest interest in the welfare of the Institute, had spontaneously made the suggestion that a fund for this purpose should be started at the dinner that evening, and had promised to make a donation of £100 as the first contribution, but had also kindly said that if anyone would make a larger contribution to head the list she would be quite willing that her name should follow. This offer was particularly acceptable in memory of the immense amount of influence and energy which Sir Douglas Galton devoted to the

Parkes Museum and the Sanitary Institute, work that was ever in their recollection, and the Council on his death, nine years ago, decided to name a section of the Museum the Douglas Galton Gallery, in memory of him. He might say that Lady Galton had been made a Fellow of the Institute, and she was certainly entitled to that honour from every point of view.

He congratulated them upon the progress of the Institute, and he thought it might be said that they were in a most flourishing condition. There was good reason to believe that the Cardiff Congress would be a great success under the presidency of Lord Plymouth.

As to sanitary legislation, it seemed to him that there was, to a certain extent, a change going on in the methods by which our sanitary progress was to be secured in the future. Not many years ago the great idea was that local administration would be best secured by decentralisation, and rural councils, urban councils, county councils, and finally parish councils were all inaugurated with the object of giving more local self-government to the people: but it appeared to him that there was now rather a contrary tide setting in. We were finding that some of these local bodies had not entirely satisfied the demands made upon them. Of course they protested very vigorously that they had, but he was afraid that much remained to be done before local bodies fully acted up to their responsibilities, and he believed it was not so much fresh legislation that was required as the knowledge and the will on the part of the local bodies themselves to put all their powers in force, and he thought that the proposal to give increased powers to the larger bodies like county councils was a move in the right direction. His experience of a county council in the north (an excellent body, over which he presided) was to the effect that the council were most eager for sanitary improvement, but he had observed one curious thing. County Councillor A., for instance, was most anxious that all rivers in the county should be kept absolutely pure, with one exception, *i.e.*, the river, or that part of the river, which ran through the district which he represented. The smaller the body the more that sort of thing existed, and he believed it was inseparable from human nature, and he thought the remedy was to give power to large bodies rather than to smaller ones. But there was one proviso. He had no objection to giving the central authority power to compel local bodies to do their duty, but he thought that we ought to look very jealously at a disposition which had been shown from time to time lately to enable the central authority not only to compel the local authorities to do more and more themselves, but to force them to pay for it. He could not believe that it was a right principle that the central government should practically impose a local rate. He regarded that as contrary to the first principles of local government.

Mr. H. D. Searles Wood, F.R.I.B.A., the Chairman of the Council, acknowledged the toast.

Sir Shirley F. Murphy proposed the toast of "The Visitors," which was responded to by Sir Douglas Powell, Bart., K.C.V.O.

Sessional Meeting.

Shrewsbury, May 23rd. The meeting was held in the Music Hall, when a discussion on "The Inspection of Dairies and Cowsheds" was opened by T. W. H. Garstang, M.A., M.R.C.S., D.P.H., Medical Officer of Health, Bucklow R.D. The chair was taken by Col. J. Lane Notter, M.A., M.D., R.A.M.C., Deputy-Chairman of the Council of the Institute. A visit was made to the Shrewsbury Sewage Farm, and a Drive to Haughmond Abbey, where the Members were entertained at Tea by Dr. J. Wheatley.

Examinations.

The following Examinations have been held:—

Sanitary Science as applied to Buildings and Public Works.

Edinburgh, May 8th and 9th.... 4 candidates; 2 certificates granted.
Leeds, May 15th and 16th ..... 7 candidates; 3 certificates granted.
London, May 22nd and 23rd ...32 candidates; 11 certificates granted.

Qualifying for Membership.

London, May 22nd and 23rd. 1 candidate; 1 certificate granted.

Women Health Visitors and School Nurses.

London, May 22nd and 23rd. 5 candidates; 2 certificates granted.

Inspectors of Nuisances.

Edinburgh, May 8th and 9th. 22 candidates; 8 certificates granted.
Leeds, May 15th and 16th. 38 candidates; 12 certificates granted.
London, May 22nd and 23rd. 93 candidates; 36 certificates granted.

Hygiene in its bearing on School Life.

Edinburgh, May 8th and 9th. 7 candidates; 7 certificates granted.
Leeds, May 15th and 16th. 23 candidates; 10 certificates granted.
London, May 22nd and 23rd. 7 candidates; 3 certificates granted.

Inspectors of Meat and other Foods.

Liverpool, May 1st and 2nd. 17 candidates; 7 certificates granted.

Candidates who have received Certificates.

Sanitary Science as applied to Buildings and Public Works.

Bennett, Malcolm Beresford.
Brown, Robert.
Brown, William Alfred.
Dow, Thomas Cramp.
Farrer, Frederick Robert.
Harrington, Wilfrid Williams.
Hooper, Harold Thomas.
Jones, John Griffith.
Khosla, Ratan Chand.
Kinch, Maurice Whinley.
Nunn, Lewis Edgar.
Quigley, John, Junr.
Rogers, William Jenkins Claxton.
Self, Arthur Sydney.
Sharp, Harold Gibbon.
Wood, James William.

Inspectors of Nuisances.

Alldritt, Frances Emily.
Armitage, Frank.
Avis, Robert Thomas.
Arnold, Frances.
Bagot, Herbert Roberts.
Barratt, Sarah Grace.
Bland, Samuel Patrick.
Borgars, William Henry.

Britton Charles Frank.
Brown, Kathleen.
Brocklebank, Olive.
Chubb, Frederick Ernest.
Clapson, Herbert William.
Davies, Marian Gwyneth.
Dent, Ethel Augusta.
Drake, William Ramsden.
Drew, John Henry.
Drieselman, Muriel Dorothy.
Goundry, Walter Edwin.
Gray, John William.
Haysey, William Lewis.
Hoban, Richard.
Hosken, Wilfrid.
Hudson, Arthur.
Jackson, John William.
Johnson, Percy Alfred.
Jones, Margaretta Lloyd.
Jordan, Percy Albert.
Kennedy, James.
King, Arthur James.
Kirk, Elizabeth.
Knowelden, Charles Albert.
Lee, Alfred.
Luck, George Ernest.
Marsh, Charlotte Augusta Leopoldine.
McIntyre, Hugh.
McKenrie, George.
Menon, Chittayil Pamameswara.
Mitchell, George Edwin.
Mitchell, George William.
Newcomen, Thomas Guy.
Pagdin, William Wylie.
Paterson, George.
Pike, John Percy.
Price, John Rowland.
Robertson, Kathleen, McLean.
Seymour, Gurth Haco.
Smith, Albert Edward.
Thomas, Joshua.
Thomson, Alex. Leslie.
Towle, Thomas Robert Burton.
Warrington, Tom.
West, Arthur Smith.
Whipp, Alfred Herbert.
Woodhall, Percy C.
Yeats, George.

Inspectors of Meat and other Foods.

Belford, James.
Clarkson, Ernest William.
Ellison, Arthur.
Laws, George.
Mason, George William.
Wharam, Samuel.
Yorke, John.

Hygiene in its Bearing on School Life.

Blackburn, Joe.
Bretton, Alice.
Bruhl, Alice.
Charlton, Constance Marion.
Dinsdale, Annie.
Gough, Isabel.
Harling, Thomas.
Hood, Ida Shepherd.
Horsfall, Edith Alice.
Houston, Effie Scott.
Inglis, William Dickson.
Logan, Mary Agnes.
Lovegrove, Rose.
Macdonald, Isabella.
Maynard, Edith Louisa.
Rhodes, Eleanor.
Roberts, Mary J.
Watt, Helen Meikle.
Wood, Sarah Ann.
Young, Agnes Siddons.

Qualifying for Membership.

Marshall, William Gray.

Women Health Visitors and School Nurses.

Letters, Fanny Riordan.
Sharp, Amy Louisa.

FORTHCOMING MEETINGS.

London, June 13th, 11 a.m. Discussion on "Pasteurization of Milk," to be opened by Prof. Henry R. Kenwood, M.B., D.P.H., Medical Officer of Health, Stoke Newington. In the afternoon a visit will be made to Sudbury Park Dairy Farm and the Walker Gordon Laboratories, by invitation of Mr. and Mrs. G. Titus Barham, who are entertaining the Members at a Garden Party.

Coventry, June 20th. Discussion on "Some Aspects of the Housing Problem and Town Planning," to be opened by E. H. Snell, M.D., B.Sc., D.P.H., Medical Officer of Health, and J. E. Swindlehurst, M.Inst.C.E., City Engineer. In the afternoon visits will be made to places of interest in the City and to Kenilworth Castle.

Examinations.

In Sanitary Science as applied to Buildings and Public Works, for Inspectors qualifying for membership, in Hygiene in its bearing on School Life and for Inspectors of Nuisances.

Dublin, June 12th and 13th.
Manchester, June 19th and 20th.
Cardiff, June 26th and 27th.
Birmingham, July 3rd and 4th.

For Inspectors of Meat and other Foods—
London, May 29th and 30th.
Leeds, July 24th and 25th.

Calendar, June and July, 1908.

As far as at present arranged.

The Parkes Museum is open free, on Mondays 9.30 a.m. to 8 p.m., other days 9.30 a.m. to 5.30 p.m. The Library and Office are closed at 1 p.m. on Saturdays.

JUNE.

12 F. } Examinations—Dublin.
13 S. }

13 S. **Sessional Meeting,** London, at 11 a.m. Discussion on "Pasteurization of Milk," to be opened by Prof. R. H. Kenwood, M.B., D.P.H., Medical Officer of Health, Stoke Newington. In the afternoon a visit will be made to the Sudbury Park Dairy Farm and the Walker Gordon Laboratories by invitation of Mr. G. Titus Barham.

19 F. } Examinations—Manchester.
20 S. }

20 S. **Sessional Meeting,** Coventry, at 11 a.m. Discussion on "Some Aspects of the Housing Problem and Town Planning," to be opened by E. H. Snell, M.D., B.Sc., D.P.H., Medical Officer of Health, and J. E. Swindlehurst, M.Inst.C.E., City Engineer. In the afternoon visits will be made to places of interest in the City and to Kenilworth Castle.

26 F. } Examinations—Cardiff.
27 S. }

JULY.

3 F. } Examinations—Birmingham.
4 S. }

13-22. **Congress and Exhibition, Cardiff.**

24 F. } Examination for Inspectors of Meat and Other Foods, Leeds.
25 S. }

LIST OF FELLOWS, MEMBERS AND ASSOCIATES ELECTED,

MAY, 1908.

FELLOWS.

Reg. No.	Date of Election.	
898	1908. May.	BOURKE, Surgeon-General G. Deane, C.B., R.A.M.C., L.R.C.P.I., L.M., L.R.C.S.I., *Principal Medical Officer, Irish Command. Dublin Castle.*
606	1908. May.	BRODIE, John Shanks, M.INST.C.E., *Borough Engineer, Town Hall, Blackpool.*
2213	1908. May.	ELKINGTON, J. S. C., M.D., D.P.H., J.P., *Chief Health Officer, Hobart, Tasmania.*
1625	1908. May.	FREMANTLE, Francis G., M.A., M.B., M.CH., M.R.C.P., D.P.H., F.R.C.S., 30, *Chester Street, Belgrave Square, S.W.*
1284	1908. May.	GALTON, LADY, *Himbleton Manor, Droitwich* (12, *Chester Street, S.W.*).
1326	1908. May.	PALMER, Philip Henry, M.INST.C.E., *Town Hall, Hastings.*
2303	1908. May.	ROBERTSON, John, M.D., B.SC., *(M.O.H.), Council House, Birmingham.*
1181	1908. May.	*SMITH, Frederick John Osborne, A.R.I.B.A., 7, *Old Queen Street, Westminster, S.W.*
1426	1908. May.	WATSON, John Duncan, M.INST.C.E., *Engineer to the Birmingham Tame and Rea District Drainage Board, Tyburn, near Birmingham.*

MEMBERS.

* Marked thus have passed the Examination of the Institute in Sanitary Science as applied to Buildings and Public Works.

‡ Marked thus have passed the Examination for Inspectors of Nuisances.

Reg. No.	Date of Election.	
2347	1908. May.	ATTRIDGE, Henry L., F.I.S.E., F.R.MET.SOC., *Beecroft, Oldfield Road, Sea Point, Cape Town, S.A.*
2148	1908. May.	CAPON, Edward Robert, *Engineer and Surveyor Epsom U.D.C., Waynflete, 20, Station Road, Epsom.*
2449	1908. May.	CLEMENTS, Major R. W., M.B., B.CH.(R.U.I.), D.P.H. CAMB., D.T.M., R.A.M.C., *Sanitary Officer, IXth Division, India, Wellington, India.*
2450	1908. May.	COOKSON, Thomas, ASSOC.M.INST.C.E., *Borough Engineer and Surveyor, Town Hall, Preston.*
2451	1908. May.	EDWARDS, William Lloyd, L.R.C.P., M.R.C.S., D.P.H. LOND., *Gwynfryn, Barry, Glam.*

2455 1908. May. *‡James, Charles Thomas, 4, *Paxton Terrace, Barrow-in-Furness.*

2456 1908. May. McDonald, James Ratcliff, F.A.S.I., 11, *Grocers' Hall Court, Poultry, E.C.*

2457 1908. May. Mason, J. Wright, M.B., C.M., M.R.C.S., D.P.H., (*M.O.H.*), *Town Hall, Hull.*

2458 1908. May. Robinson, Alfred, M.D., (*M.O.H.*), *Town Hall, Rotherham.*

2459 1908. May. Rocyn-Jones, David, M.B., C.M.EDIN., D.P.H.OXON., (*M.O.H.*), *County Medical Officer, Abertillery, Monmouth.*

2460 1908. May. Sims, Sydney Bennett, *Borough Engineer and Surveyor, Hamilton, Waikato, New Zealand.*

2461 1908. May. Strachan, The Hon. W. Henry W., C.M.G., L.R.C.P. M.R.C.S., 56, *Wickham Road, Brockley, S.E.*

2462 1908. May. *‡Sumner, Evan, *Sanitary Office, Town Hall, Bolton.*

2463 1908. May. Swindlehurst, Joseph Eaves, M.INST.C.E., *City and Water Engineer, St. Mary's Hall, Coventry.*

ASSOCIATES.

‡ Marked thus have passed the Examination for Inspectors of Nuisances.

§ Marked thus have passed the Examination in Practical Hygiene for School Teachers

Reg. No. Date of Election.

4428 1908. May. ‡Brook, Sergt.-Major Benjamin George, R.A.M.C., *Eden Villa, Derby Road, Ipswich.*

4429 1908. May. ‡Dolphin, George, *Forgate Street, Astwood Bank, Redditch.*

4430 1908. May. ‡Durrant, Walter Edmund, 74, *Northgate Street, Great Yarmouth.*

4431 1908. May. ‡Gurney, Malcolm Grace, 8, *Heath Road, Leighton Buzzard, Beds.*

4432 1908. May. ‡Hurst, William Henry James, 36, *High Street, Southampton.*

4433 1908. May. ‡Miller, Miss Jane Harriet, 42, *Trinity Street, Hull.*

4434 1908. May. ‡Penney, Joseph, 107, *Mersey Road, Widnes.*

4435 1908. May. ‡Riding, Harry, *Albert Crescent, Southport Road, Ormskirk, Lancs.*

4436 1908. May. ‡Smith, Frederick, 21, *Upper Brook Street, Ipswich.*

4437 1908. May. ‡Statham, Arthur Percy, *Borough Engineer's Office, Town Hall, Salford.*

4438 1908. May. §Umfreville, Miss Dorothy Joan, *South Grove, Horsham, Sussex.*

4439 1908. May. ‡Warren, Arthur Samuel, 14, *Clavcrton Buildings, Bath.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY.*

*** For Publications of Societies and Institutions, etc., see under "Academies."*

ACADEMY (American).

Philadelphia. *American Climatological Association.* Transactions of the American Climatological Association, Vol. 23, 1907. 330 pp., 8vo. Philadelphia, 1907. *The Association.*

ACADEMIES (British).

London. *British Association for the Advancement of Science.* Report of the Seventy-seventh Meeting of the British Association for the Advancement of Science, Leicester. 983 pp., 8vo. London, 1908. *The Association.*

——— *Incorporated Society of Medical Officers of Health.* Index to "Public Health," Vol. XIX., Oct., 1906, to Sept., 1907, and Vol. XX., Oct. 1907, to Feb., 1908. 70 pp., 8vo. London, 1908. *The Society.*

Abercromby, *Hon. R.* Weather: a Popular Exposition of the nature of Weather Changes from day to day. Third Edition. 491 pp., 8vo. London, 1892. *W. Whitaker, B.A., F.R.S.*

Bannister, *K. O., and* **Turner,** *G.* Hastings Souvenir, Conference of the National Union of Teachers, 1908. 250 pp., 8vo. London and Oxford, 1908. *Robert C. Evans & Co.*

Berne. Annuaire Statistique de la Suisse. Seizième Année, 1907. 392 pp., 8vo. Berne, 1908.

——— Les Asiles contonaux d'aliénés de la Suisse. 43 pp., 4to. Berne, 1908. *The Bureau de Statistique.*

Caton, *R., M.D., F.R.C.P., J.P.* How to Live: a Short account, in simple words, of the Laws of Health, with brief reference to Habits and Conduct. Written for the Inmates of the Corporation Dwellings, Liverpool. 35 pp., 8vo. Liverpool, 1906. *W. Whitaker, B.A., F.R.S.*

Factories and Workshops. Supplement to the Annual Report of the Chief Inspector for the Year 1906. I.: Returns of Persons Employed in 1904 in Non-Textile Factories; II.: Summary of Annual Reports of Medical Officers of Health for 1906. 19 pp., fcp. London, 1908. *The Chief Inspector.*

Hoff, *Dr. E. M.* Sterblichkeitsverhältnisse von Köbenharn, mit 5 Statistischen Tabellen. 8 pp., 4to. Leipzig, 1908. *The Author.*

London County Council. Nuisance from Flies: Report by the Medical Officer presenting a Report by Dr. Hamer, Medical Officer (General Purposes), on the Extent to which Fly Nuisance is produced in London by the accumulations of offensive matter. 10 pp., fcp. London, 1908. *Sir Shirley Murphy.*

Local Government Board. Dr. F. St. George Mivart's Report on the General Sanitary Circumstances and Administration of the Bedale Rural District, and on a Prevalence of Diphtheria in the Township of Bedale. No. 302. 15 pp., fcp. London, 1908. *A. Newsholme, M.D., F.R.C.P., D.P.H.*

London. *Public Health Department.* Contaminated Milk. Reports of the Medical Officer of Health, 1908. 10 pp., fcp. London, 1908. *W. Collingridge, M.A., M.D., D.P.H.*

Perth. *Education Department.* The Curriculum of the Primary Schools, 1908. 68 pp., 8vo. Perth, 1908. *The Education Department.*

Western Australia. *Education Department.* Lessons on the Laws of Health. 162 pp., 8vo. Perth, 1908. *The Education Department.*

Venable, *William Mayo, M.S.* Methods and Devices for Bacterial Treatment of Sewage. 236 pp., 8vo. London and New York, 1908. *Chapman & Hall, Ltd. (Publishers).*

THE

TWENTY-FOURTH CONGRESS,

1908,

WILL BE HELD AT

CARDIFF,

From JULY 13th to 18th.

GENERAL ARRANGEMENTS.

ADDRESSES AND LECTURES.

President's Inaugural Address.

Lecture to the Congress.

Popular Lecture.

SECTIONS.

A.—Section I. Sanitary Science and Preventive Medicine.

B.—Section II. Engineering and Architecture.

CONFERENCES.

C.—Of Municipal Representatives.

D.—Of Port Sanitary Authorities.

E.—Of Medical Officers of Health.

F.—Of Engineers and Surveyors to County and Sanitary Authorities.

G.—Of Veterinary Inspectors.

H.—Of Sanitary Inspectors.

J.—Of Women on Hygiene.

K.—On the Hygiene of School Life.

EXHIBITION.

An Exhibition of Apparatus and Appliances relating to Health and of Domestic use will be held in connection with the Congress.

PAPERS AND DISCUSSIONS.

The Council invite Papers on subjects relating to Health and Sanitary Science. Papers are limited to about 3,000 words. Accepted papers are, as far as possible, printed and distributed in the Reception Room before they are discussed, and at the Meeting they are taken as read. Authors are allowed five minutes to introduce the main arguments of the paper before the discussion begins. A short abstract must accompany every Paper, both for the convenience of the Press at the Congress and for insertion, subject to the approval of the Council, in the Journal of the Institute, should it not be deemed desirable to publish the paper *in extenso*. No previously published Paper can be accepted. The acceptance of Papers, and the days on which they are to be discussed, are determined by the Council before the beginning of the Meeting, and published in the Daily Programmes, obtainable in the Reception Room. The Council reserve the right of refusing any Papers sent in; and in the case of those accepted, the discussion of them must depend on the time at the disposal of the Meeting. Papers accepted for the Congress cannot be published by the Authors, except by permission of the Council. The Council reserve to themselves the privilege of printing any Paper, either wholly or in part, or of refraining from the publication thereof, if they see fit.

Authors should forward their manuscript by post *as early as possible, and in any case not later than June 15th*, addressed to the Secretary, Royal Sanitary Institute, Margaret Street, London, W.

RESOLUTIONS.

Resolutions put from the Chair at the Meetings must only be in the form of recommendations to the Council of the Institute, by whom all such recommendations will be carefully considered. The number of persons present, and the proportions voting, must be recorded by the Chairman for the information of the Council.

No Resolution can be proposed at any of the Sections or Conferences, unless *sent to the Secretary of the Section or Conference in time for approval and insertion in the Programme for the day on which it is to be proposed.*

No Resolutions can be put to a Meeting unless, in the opinion of the President (or Chairman for the time being), the Section is adequately represented.

RECEPTION ROOM AND PLACES OF MEETING.

A Reception Room will be opened at The Law Courts, on Monday, July 13th, at Noon, and on the following days at 9 A.M. till 4 P.M., for the issue of all Tickets in connection with the Congress. The Reception Room will be available for Reading, Writing, and Conversation.

The Inaugural Address of the President, the Lecture to the Congress, and the Popular Lecture will be given in The City Hall.

The Sectional Meetings, General Meetings, and Conferences will be held in The City Hall, Law Courts, and The Engineers' Institute.

The Exhibition will be held in The Exhibition Pavilion, Cathays Park, Cardiff.

HOTEL AND LODGING ACCOMMODATION, AND TRAVELLING ARRANGEMENTS

Will be determined by the Local Committee, and information relating to the same may be obtained from the Local Secretary, and from the Secretary of the Institute.

TICKETS.

Fellows, Members, and Associates of the Institute, are supplied with Tickets for the Congress on application to the Secretary before the Congress, or may be obtained at the Reception Room during the Meeting.

To those not connected with the Institute, Congress Tickets will be issued, entitling the holder to the use of the Reception Room, to admission to the Presidential and other Addresses, to all Meetings, to the Exhibition of the Institute, to any Conversazione given by the Institute, and copies of the Monthly Journal of the Institute containing the proceedings of the Congress. The price of the Congress Tickets is £1 1s. each. Ladies' Tickets (not including copies of the Proceedings), 7s. 6d. each. These Tickets may be obtained up to Thursday, July 9th, at the Office of the Local Secretary at City Hall, Cardiff, or at the Offices of The Institute, 72, Margaret Street, London, W., and on July 13th and following days between 9 a.m. and 4 p.m. in the Reception Room in the Law Courts.

EXCURSIONS.

Particulars of these will be published in the local Programme, and Tickets and List of Places to be visited can be obtained at the Reception Room during the Meeting.

RAILWAY ARRANGEMENTS.

The Railway Companies have decided to issue return Tickets to Cardiff at a single fare and a quarter, available from July 9th to the 27th. Certificates necessary to obtain this reduction will be supplied with Congress Tickets. Return Tickets at a single fare and a quarter for the double journey will (for residential purposes) be issued to members of the Congress, on production of their Congress Tickets, from Cardiff to stations not more than fifty miles distant –(minimum charge 1s.).

Officers of the Congress.

President.

THE RIGHT HON. THE EARL OF PLYMOUTH, P.C., C.B., D.L., J.P., Lord-Lieutenant of Glamorganshire.

Vice-Presidents.

THE RT. HON. THE LORD MAYOR OF CARDIFF (Councillor ILLTYD THOMAS, J.P.)
THE MOST NOBLE THE MARQUIS OF BUTE.
THE RIGHT HON. VISCOUNT TREDEGAR, D.L., J.P., Lord-Lieutenant of Monmouth.
THE RIGHT HON. EARL OF DUNRAVEN, K.P., C.M.G., P.C.
THE RIGHT HON. LORD ABERDARE, D.L., President, University of Wales.
THE RIGHT REV. THE LORD BISHOP OF LLANDAFF (REV. J. P. HUGHES, D.D.)
SIR CLIFFORD J. CORY, Bart., J.P., M.P.
SIR WILLIAM THOMAS LEWIS, Bart., K.C.V.O., D.L., J.P.
SIR JOHN TALBOT DILLWYN LLEWELYN, Bart., D.L., J.P.
SIR JOHN WILLIAMS, Bart., K.C.V.O., M.D., D.Sc., LL.D.
SIR WILLIAM S. CROSSMAN, Kt., J.P., Ex-Lord Mayor of Cardiff.
SIR JOHN GUNN, Kt., J.P.
THE HON. IVOR C. GUEST, M.P.
ROBERT FORREST, J.P.
JOHN CORY, J.P.
OLIVER HENRY JONES, J.P.

Chairman of Local Committee.

COUNCILLOR JAMES ROBINSON, L.R.C.P., Chairman of the Health and Port Sanitary Committee, Cardiff.

Vice-Chairmen.

Councillor R. J. SMITH, M.B.
J. HOWARD-JONES, M.D., C.M., D.SC.
P. J. O'DONNELL, L.R.C.S.I.
Col. HENRY LEWIS, J.P.
Principal E. H. GRIFFITHS, M.A., SC.D., F.R.S.
T. F. HARVEY, A.M.INST.C.E.
R. H. WYRILL, M.INST.C.E.

Hon. Local Treasurer.

J. ALLCOCK, F.S.A.A., City Treasurer, Cardiff.

Hon. Local Secretaries.

E. WALFORD, M.D., D.P.H.
W. WILLIAMS, M.A., M.D., D.P.H.

Local General Committee.

(Consisting of about 800 Members.)

Executive Committee.

Chairman—Councillor J. ROBINSON, L.R.C.P.

Vice-Chairman—Councillor H. C. VIVIAN (Deputy Lord Mayor).

THE RIGHT HON. THE LORD MAYOR OF CARDIFF
THE LADY MAYORESS.
THE RIGHT HON. THE EARL OF PLYMOUTH, P.C., C.B., D.L., J.P.
THE MOST NOBLE THE MARQUIS OF BUTE.
THE RIGHT HON. VISCOUNT TREDEGAR, D.L., J.P. [D.L., J.P.
THE RIGHT HON. LORD ABERDARE.
THE RIGHT REV. THE LORD BISHOP OF LLANDAFF.
LORD NINIAN CRICHTON STUART.
THE HON. IVOR C. GUEST, M.P.
THE MAYOR OF SWANSEA.
THE MAYOR OF NEWPORT.
THE MAYOR OF MERTHYR
THE CHAIRMAN OF THE MONMOUTH COUNTY COUNCIL.
THE CHAIRMAN OF THE CARMARTHEN COUNTY COUNCIL.
THE TOWN CLERK, CARDIFF.
THE CLERK TO THE CARMARTHEN COUNTY COUNCIL.
THE CLERK TO THE MONMOUTH COUNTY COUNCIL.
ABBOTT, Miss E. C., M.A.
ALEXANDER, D. T., J.P.
ALLAN, J., J.P.
ANDREWS, T., J.P.
ANSTEY-CHAVE, T., M.B.
ANSTEY-CHAVE, Mrs. T.
AUGUST, E. J.
BALLINGER, J.
BARBIER, Professor P.
BEASLEY, A.
BEAVAN, Alderman F. J., J.P.
BIRD, Alderman C. H., J.P.
BLIGHT, Miss M. Y.
BOULTON, Professor W. S., B.Sc., F.G.S.
BOWEN-JONES, L. M., L.R.C.P., M.R.C.S., D.P.H.
BRIERLEY, E. E., M.B., C.M.
BROAD, B. W., M.B.
BRUTON, EDWARD H., F.R.I.B.A.
BUIST, J. J., M.B.
BUSH, J.
CANTILLON, Councillor D. E., M.D.
CANTILLON, Mrs. C.
CAREY, Alderman P. W., J.P.
CLARKE, H. ALEX.
COLLIN, Miss M., B.A.
COLLINS, E. TENISON, M.R.C.S.
COOK, H. G. G., M.D., F.R.C.S., D.P.H.
CORBETT, E. W. M., M.S.A., J.P.
CORY, JOHN, J.P.
CORY, Sir CLIFFORD, Bart., J.P., M.P.
COURTIS, J. W., J.P.
CRESSWELL, F. P. S., B.S., M.B.
CROSSMAN, Alderman Sir W. S., Kt., J.P.
DAVIES, D. S., M.D., D.P.H.
DAVIES, F. W. S., M.R.C.S., L.R.C.P.
DAVIES, Miss HESTER.
DAVIES, W.
DOVEY, C. E., J.P.
DOWNING, C., L.R.C.P., M.R.C.S.
DRANE, R. [D.P.H.
EDWARDS, W. LLOYD, L.R.C.P., M.R.C.S.,
EDWARDS, W. T., M.D., J.P.
ELLIS, ARTHUR, M.I.M.E., M.I.E.E.
ENSOR, H. C., M.R.C.S.
EVANS, D. J., B.Sc.
EVANS, F. W. M., M.D., C.M.
EVATT, E. J., M.B., B.S.
FAWCKNER, E. H.
FISHER, R.
FITZGERALD, D. A., F.R.C.S.I., D.P.H.
FORREST, R., J.P.
FRANKLIN, T. MANSEL.
GOODALL, E., M.D., B.S., F.R.C.P.
GRAY, F. R.
GRIFFITHS, Principal E. H., M.A., Sc.D., F.R.S.
GRIFFITHS, P. Phys., M.B., B.S.
GUNN, Sir J., Kt., J.P.
GUY, W.
HAGERTY, Miss E. G.
HANDCOCK, E.
HARPUR, W., M.I.C.E.
HAWKINS, W. R.
HAYCRAFT, Professor J. B., M.D., D.Sc., F.R.S.E.
HEPBURN, Professor D., M.D., C.M., F.R.S.E.
HOLDEN, J., A.M.I.C.E.
HOPKINS, W.
HOWARD-JONES, J., M.D., C.M., D.Sc.
HOWELL, JAMES (Jun.).
HUGHES, Alderman R., J.P.
HUGHES, Mrs. R.
HUGHES, GWILLYM.
HUGHES, J. A.
HUGHES, Miss E. P.
HUGON, Miss L. G., M.A.
HURMAN, J.
INGLEDEW, J. P., J.P.
JACKSON, C. J., J.P.
JACKSON, J. J., B.A.
JACOBS, T. WINDSOR, J.P.
JAMES, CHOLTON.
JENKINS, A. K.
JENKINS, J. AUSTIN, B.A.
JENKINS, J. BLANDY, J.P.
JONES, HERBERT, L.R.C.S.I., D.P.H.
JONES, O. H., J.P.
KENT, E.
LAKE, E.
LAMB, F. W., B.A., M.D., D.P.H.
LEANING, J. J.
LEE, Major-Gen. H. H., J.P.
LEWIS, CYRIL, M.D.
LEWIS, Col. H., J.P.
LEWIS, GETHING, J.P.
LEWIS, Sir W. T., Bart., J.P.
LLEWELLYN, L.
LLEWELYN, Sir J. T. D., Bart., J.P.
LONG, Miss E.
LOWE, E. A.
MACKENZIE, Mrs. M.
MACLEAN, E. J., M.D., C.M.
MARKS, Miss K. O.
MARTIN, H. W., J.P.
MARTIN, J. M., B.A., M.D., D.P.H.
MEE, ARTHUR.
MORGAN, Alderman LEWIS.
MORGAN, DAVID.
MORGAN, D. B.

Excursions Sub-Committee.

Chairman—Councillor H. C. VIVIAN (Deputy Lord Mayor).

BEASLEY, A.
BOULTON, Professor W. S., B.Sc., F.G.S.
CAREY, Alderman P. W., J.P.
ELLIS, ARTHUR, M.I.M.E., M.I.E.E.
GRAY, F. B.
GUY, W.
HOPKINS, W.
HUGHES, Alderman R., J.P.
HURMAN, J.
LAKE, E.
LEANING, J. J.
LLEWELLYN, L.
MARTIN, H. W., J.P.
PRIESTLEY, C. H., M.I.C.E.
REES, W. BEDDOE.
TAYLOR, A. E., M.B., C.M.
TROUNCE, Alderman W. J., J.P.
WARD, J., F.S.A.
WILLIAMS, D. T., M.R.SAN.I.

And the Chairman of the Executive Committee as also the Hon. Local Secs. and Treasurer *ex officio*.

Literary and Press Sub-Committee.

Chairman—J. BALLINGER, Librarian, Free Libraries, Cardiff.

BARBIER, Professor P.
DAVIES, W.
EVANS, D. J., B.Sc.
EVATT, E. J., M.B., B.S.
HEPBURN, Professor D., M.D., C.M., F.R.S.E.
HUGHES, GWILLYM.
HUGHES, Miss E. P.
JACKSON, J. J., B.A.
JENKINS, J. AUSTIN, B.A.
KENT, E.
LAMB, F. W., B.A., M.D., D.P.H.
MEE, ARTHUR.
PRICE, H., M.A.
READ, H.
SWASH, A. W.

And the Chairman of the Executive Committee, as also the Hon. Local Secs. and Treasurer *ex officio*.

Exhibition Sub-Committee.

Chairman—Alderman SIR W. S. CROSSMAN, Kt., J.P.

ALEXANDER, D. T., J.P.
ALLAN, J., J.P.
ANDREWS, T., J.P.
BOWEN-JONES, L. M., L.R.C.P., M.R.C.S., D.P.H.
BROAD, B. W., M.B.
BRUTON, EDWARD H., F.R.I.B.A.
BUSH, J.
CANTILLON, Mrs.
CAREY, Alderman P. W., J.P.
CLARKE, H. ALEX.
COOK, H. G. G., M.D., F.R.C.S., D.P.H.
CORBETT, E. W. M., M.S.A., J.P.
DRANE, R.
EVANS, EDGAR L., A.M.I.C.E.
FAWCKNER, E. H.
GRIFFITHS, P. RHYS, M.B., B.S.
HANDCOCK, E.
HARPUR, W., M.I.C.E.
HOLDEN, J., A.M.I.C.E.
HOWARD-JONES, J., M.D., C.M., D.SC.
HUGHES, J. A.
JACKSON, C. J., J.P.
JAMES, OHOLTON.
JENKINS, A. K.
LEWIS, Col. H., J.P.
LOWE, E. A.
MORGAN, DAVID.
MORGAN, D. R.
MORGAN, GOMER S.
MORRIS, T. H., M.B.
PARDOE, J. C., A.M.I.C.E.
PRIESTLEY, C. H., M.I.C.E.
PROGER, T. W.
PUGH-JONES, J., F.S.I., M.S.A., F.G.S., M.R.SAN.I.
REES, W. BEDDOE.
RICHES, T. HURRY, M.I.C.E., J.P.
ROBERTS, D. E., M.I.C.E.
ROBINSON, Mrs.
SAWYER, E. J.
SCHOLBERG, H. A., M.B., D.P.H.
SEWARD, E., F.R.I.B.A.
SMITH, Councillor R. J., M.B.
TAYLOR, A.
TAYLOR, A. E., M.B., C.M.
TAYLOR, Councillor J.
TROUNCE, Alderman W. J., J.P.
TURNER, J. E.
VAUGHAN, Col. E. W. BRUCE, F.R.I.B.A.
WAITE, E. W., A.M.I.C.E.
WARD, J., F.S.A.
WATERFALL, C. J., F.I.C., F.C.S.
WILLOUGHBY, P. R. A.

And the Chairman of the Executive Committee, as also the Hon. Local Secs. and Treasurer *ex officio*.

Executive Committee (continued).

MORGAN, GOMER S
MORGAN, Miss L. M.
MORRIS, T. H., M.B.
NEWBERRY, Miss B.
PARDOE, J. C., A.M.I.C.E.
PATERSON, D. R., M.D., C.M.
PRICE, H., M.A.
PRIESTLEY, C. H., M.I.C.E.
PROGER, T. W.
PUGH-JONES, D., F.S.I., M.S.A., F.G.S., M.R.SAN.I.
READ, H.
REES, HOWELL, L.R.C.P., M.R.C.S., J.P.
REES, W. BEDDOE.
RICHES, T. HURRY, M.I.C.E., J.P.
ROBERTS, D. E., M.I.C.E.
ROBERTS, Miss G.
ROBINSON, Mrs. J.
SAWYER, E. J.
SCHOLBERG, H. A., M.B., D.P.H.
SEWARD, E., F.R.I.B.A.
SHEEN, W., M.S., M.D., F.R.C.S.
SMITH, Miss M. A.
SMITH Councillor R. J., M.B.
STEVENS, W. MITCHELL, M.D.
SWASH, A. W.
SYMONDS, W. T., J.P.
TAYLOR, A.
TAYLOR, A. E., M.B., C.M.
TAYLOR, Councillor J.
THOMAS, J. LYNN, C.B., F.R.C.S.
THOMPSON, J. TATHAM, M.B., C.M.
TREASURE, W. B. C., M.D., J.P.
TROUNCE, Alderman W. J., J.P.
TURNER, J. E.
VACHELL, C. T., M.D., J.P.
VACHELL, H. R., M.D., C.M.
VAUGHAN, Col. E. M. BRUCE, F.R.I.B.A
WALLACE, T., M.D., J.P.
WAITE, E. W., A.M.I.C.E.
WARD, J., F.S.A.
WARREN, M.
WATERFALL, C. J., F.I.C., F.C.S.
WILLIAMS, D. T., M.R.SAN.I.
WILLIAMS, Sir JOHN, Bart., K.C.V.O., M.D., D.SC., LL.D.
WILLMOTT, E. C.
WILLOUGHBY, P. R. A.
WITT, Miss L. M.

And the Hon. Local Secs. and Treasurer *ex-officio*.

Finance Sub-Committee.

Chairman -C. E. DOVEY, J.P.

AUGUST, E. J.
BEAVAN, Alderman F. J., J.P.
BIRD, Alderman C. H., J.P.
COURTIS, J. W., J.P.
DOVEY, C. E., J.P.
FISHER, R.
HOWELL, JAMES (Jun.).
JACOBS, T. WINDSOR, J.P.
JENKINS, J. AUSTIN, B.A.
WARREN, M.
WILLMOTT, E. C.
WILLOUGHBY, P. R. A.

And the Chairman and Vice-Chairman of the Executive Committee, as also the Hon. Local Secs. and Treasurer *ex officio*.

Reception and Hospitality Sub-Committee.

Chairman—SIR CLIFFORD CORY, Bart., J.P., M.P.

THE RIGHT HON. THE LORD MAYOR.
THE LADY MAYORESS.
LORD NINIAN CRICHTON STUART.
THE HON. IVOR C. GUEST, M.P.
THE MAYOR OF SWANSEA.
THE MAYOR OF NEWPORT.
THE MAYOR OF MERTHYR.
THE CHAIRMAN OF THE MONMOUTH COUNTY COUNCIL.
THE CHAIRMAN OF THE CARMARTHEN COUNTY COUNCIL.
THE CLERK TO THE MONMOUTH COUNTY COUNCIL.
THE CLERK TO THE CARMARTHEN COUNTY COUNCIL.
ABBOTT, Miss E. C., M.A.
ANDREWS, T., J.P.
ANSTEY-CHAVE, Mrs. T.
BLIGHT, Miss M. Y.
CANTILLON, Councillor D. E., M.D.
CANTILLON, Mrs. C.
COLLIN, Miss M., B.A.
COOK, H. G. G., M.D., F.R.C.S., D.P.H.
DAVIES, Miss HESTER.
EDWARDS, W. LLOYD, L.R.C.P., M.R.C.S., D.P.H.
ENSOR, H. C., M.R.C.S.
FRANKLEN, T. MANSEL
GRIFFITHS, Principal E. H., M.A., SC.D., F.R.S.
HAGERTY, Miss E. G.
HAWKINS, W. R.
HEPBURN, Professor D., M.D., C.M., F.R.S.E.
HUGHES, Miss E. P.
HUGHES, Mrs. R.
HUGON Miss L. G., M.A.
JENKINS, J. AUSTIN, B.A.
JENKINS, J. BLANDY, J.P.
LEE, Major-Gen. H. H., J.P.
LEWIS, Miss C.
LEWIS, GETHING, J.P.
LONG, Miss E.
MACKENZIE, Mrs. M.
MARKS, Miss K. O.
MORGAN, Alderman LEWIS.
MORGAN, Miss L. M.
NEWBERRY, Miss G.
ROBERTS, Miss G.
ROBINSON, Mrs. J.
SMITH, Miss M. A.
SMITH, Councillor R. J., M.B.
SYMONDS, W. T., J.P.
THOMAS, J. LYNN, C.B., F.R.C.S.
VACHELL, C. T., M.D., J.P.
WALLACE, T., M.D., J.P.
WITT, Miss L.

And the Chairman of the Executive Committee, as also the Hon. Local Secs. and Treasurer *ex officio*.

The Governments, County Councils, Corporations, Local Authorities, and Societies who have up to the present appointed Delegates to the Congress.

FOREIGN GOVERNMENTS.

GOVERNMENT DEPARTMENTS (2).

Lunacy Commission. War Office.

COUNTY COUNCILS (19).

Carmarthenshire.
Cheshire.
Cumberland.
Denbighshire.
Durham.
East Sussex.
Elgin.
Haddington.
Kesteven.
Kildare.
Lancashire.
Monmouthshire.
Nottinghamshire.
Salop.
Somerset.
Staffordshire.
Warwickshire.
West Riding of Yorkshire.
Wiltshire.

COUNTY BOROUGHS (32).

Barrow-in-Furness.
Birmingham.
Bootle.
Bournemouth.
Bradford.
Brighton.
Bristol.
Croydon.
Derby.
Exeter.
Gateshead.
Glasgow.
Hanley.
Hastings.
Huddersfield.
Leeds.
Leicester.
Liverpool.
Middlesbrough.
Newcastle-on-Tyne.
Newport (Mon.)
Northampton.
Norwich.
Nottingham.
Southampton.
Southport.
Tynemouth.
Waterford.
West Bromwich.
West Ham.
West Hartlepool.
York.

METROPOLITAN BOROUGHS (5).

Hackney. London (City of). Paddington.
Stepney. Stoke Newington.

URBAN DISTRICT COUNCILS OR SANITARY AUTHORITIES (72).

Aberavon.
Aberrychan.
Abingdon.
Acton.
Ammanford.
Aston Manor.
Accrington.
Barnstaple.
Barry.
Bedford.
Berwick-on-Tweed.
Blackrock.
Bodmin.
Bollington.
Bridgend.
Brierfield.
Broughty Ferry.
Burslem.
Cambridge.
Carnarvon.
Cheltenham.
Colchester.
Congleton.
Cowbridge.
Crewe.
Criccieth.
Darlington.
Dorchester.
East Ham.
Eccles.
Farnham.
Folkestone.
Galway.
Glyncorrwg.
Govan.
Grantham.
Grimsby.
Harrogate.
Henley-on-Thames.
Ilkeston.
Jarrow.
Kidderminster.
King's Norton and Northfield.
Lancaster.
Lowestoft.
Maidstone.
Margam.
Merthyr Tydfil.
Mynyddislwyn.
Neath.
Oswestry.
Prestatyn.
Reigate.
Rhondda.
Rhymney.
Richmond (Surrey).
Stockton-on-Tees.
Southend-on-Sea.
Swindon.
Tottenham.
Wakefield.
Wallsend.
Walthamstow.
Warrington.
Wenlock.
Widnes.
Wimbledon.
Winsford.
Wood Green.
Worthing.
Wrexham.
Yeovil.

RURAL DISTRICT COUNCILS (9).

Bodmin.
Crickhowell.
Croydon.
East Dean and United Parishes.
Epsom.
Sculcoates.
Truro.
Wallingford.
Wellington (Salop).

PORT SANITARY AUTHORITIES AND OTHERS (5).

Blyth.
Leicester Sewage Works and Farms Committee.
London.
Ribble Joint Committee.
West Riding of Yorkshire Rivers Board.

EDUCATION AUTHORITIES (13).

Blackburn.
Buckinghamshire C.C.
Cardiff.
Cardiganshire C.C.
Cumberland C.C.
Flintshire C.C.
Glamorgan C.C.
Kesteven C.C.
Monmouthshire C.C.
Montgomery C.C.
Northumberland C.C.
Pembrokeshire C.C.
Rhondda.

SOCIETIES, UNIVERSITIES, COLLEGES, ETC. (37).

Architectural Association.
Association of Water Engineers.
Charing Cross Hospital Medical School.
Central Veterinary Medical Society.
Charity Organisation Society.
Geological Society of London.
Incorporated Association of Municipal and County Engineers.
Institute of Sanitary Engineers.
Junior Institution of Engineers.
London (Royal Free Hospital) School of Medicine for Women.
London School of Tropical Medicine.
Medical Officers of Schools Association.
Middlesex Hospital Medical School.
National Veterinary Association.
Royal College of Physicians.
Royal College of Physicians, Ireland.
Royal College of Surgeons, Ireland.
Royal Institute of British Architects.
Royal Society of Medicine.
Rural Housing and Sanitation Association.
St. John's Ambulance Association (Cardiff Centre).
Sanitary Inspectors Association.
Society of Architects.
Society of Arts.
Society of Engineers.
Surveyors' Institution.
University College, London.
University College of S. Wales and Monmouthshire.
University College of Wales.
University of Cambridge.
University of Durham College of Medicine.
University of Glasgow.
University of London.
University of Oxford.
University of Wales.
Victoria University of Manchester.
Women Sanitary Inspectors Association.

Proceedings of the Congress and Officers of Sections and Conferences.

Reception of the Members and Delegates in the City Hall, *Monday, July 13th, at 1 p.m.*
By THE RIGHT HON. THE LORD MAYOR.

Public Luncheon in the Assembly Room, City Hall, *at 1.30 p.m.*

Opening of the Exhibition, *at 8 p.m.*
By THE RIGHT HON. THE LORD MAYOR (Councillor Illtyd Thomas, J.P.)

Reception of the Members and Delegates in the City Hall, *7—8 p.m.*
By THE RIGHT HON. THE LORD MAYOR (Councillor Illtyd Thomas, J.P.) and LADY MAYORESS (Miss Deanie Thomas).

Inaugural Address to the Congress in the City Hall, *at 8 p.m.*
By THE RIGHT HON. EARL OF PLYMOUTH, P.C., C.B., D.L., J.P.

Lecture to Congress in the City Hall, *Wednesday, July 15th, at 8.30 p.m.*

Conversazione and Reception in the Assembly Room, City Hall, *Thursday, July 16th, at 8 p.m.*
At the Invitation of COUNCILLOR JAMES ROBINSON, L.R.C.P. (Chairman of the Local Committee).

Popular Lecture in the City Hall, *Friday, July 17th, at 8 p.m.*, on "The Prevention of Consumption."
By Prof. E. J. McWEENEY, M.A., M.D., D.P.H.

Garden Parties and Visits to Places of Interest.

For times and places of all Meetings see pages 124 & 125.

SECTIONAL MEETINGS.

Sect. 1.—"Sanitary Science & Preventive Medicine."

July 14th and 15th, to be held in THE LAW COURTS.

President.

D. S. DAVIES, M.D., D.P.H., Medical Officer of Health, Bristol.

Vice-Presidents.

Prof. D. HEPBURN, M.D., C.M., F.R.S.E.
T. R. LLEWELLYN, M.R.C.S., L.R.C.P.
C. T. VACHELL, M.D., J.P.
E. WALFORD, M.D., D.P.H.
W. WILLIAMS, M.A., M.D., D.P.H.

Secretaries.

J. HOWARD-JONES, M.D., C.M., D.SC. | J. D. JENKINS, M.D., B.S., D.P.H.
F. W. LAMB, B.A., M.D., D.P.H.

Recording Secretary.

PROF. HENRY R. KENWOOD, M.B., D.P.H., LONDON.

Section II.—"Engineering and Architecture."

July 15th and 16th, to be held in THE LAW COURTS.

President.

SIR HENRY TANNER, I.S.O., F.R.I.B.A.

Vice-Presidents.

ARTHUR ELLIS, M.I.MECH.E., M.I.E.E.
E. H. FAWCKNER, President, Cardiff and S. Wales Architects' Society.
W. HARPUR, M.INST.C.E.
E. PURNELL HOOLEY, M.INST.C.E.
D. PUGH-JONES, F.S.I., M.S.A., F.G.S.
C. H. PRIESTLEY, M.INST.C.E.
D. E. ROBERTS, M.INST.C.E.
T. HURRY RICHES, M.INST.C.E., J.P.
E. SEWARD, F.R.I.B.A.
COL. E. M. BRUCE VAUGHAN, F.R.I.B.A.
H. T. WAKELAM, M.INST.C.E.
WILLIAM WARE, J.P.
T. H. YABBICOM, M.INST.C.E.

Secretaries.

EDWARD H. BRUTON, F.R.I.B.A. | C. H. PRIESTLEY, M.INST.C.E.

Recording Secretary.

JOHN EDWARD WORTH, M.INST.C.E., LONDON.

CONFERENCES.

Municipal Representatives.

Tuesday, July 14th, to be held in THE CITY HALL.

President.

Councillor J. ROBINSON, L.R.C.P., Chairman, Health and Port Sanitary Committee, Cardiff.

Vice-Presidents.

THE WORSHIPFUL MAYOR OF ABERGAVENNY.
THE WORSHIPFUL MAYOR OF COWBRIDGE.
THE WORSHIPFUL MAYOR OF MERTHYR.
THE WORSHIPFUL MAYOR OF NEWPORT.
THE WORSHIPFUL MAYOR OF SWANSEA.
Alderman SIR WILLIAM S. CROSSMAN, Kt., J.P.
Alderman P. W. CAREY, J.P. | Alderman LEWIS MORGAN.
Councillor J. BLANDY JENKINS, J.P., Chairman, Glamorgan County Council.
Councillor R. J. SMITH, M.B.

Secretaries.

Councillor D. E. CANTILLON, M.D. | Councillor P. J. O'DONNELL.

Recording Secretary.

PHILIP BOOBBYER, M.D., NOTTINGHAM.

This Conference is open to all Members and Officials of Municipal Bodies.

Port Sanitary Authorities.

July 17th, to be held in THE LAW COURTS.

President.

Councillor JOHN UTTING, M.R.C.P., M.R.C.S., J.P., Chairman, Port Sanitary Authority, Liverpool.

Vice-Presidents.

J. HOWARD-JONES, M.D., C.M., D.SC. | Alderman LEWIS MORGAN.
T. WINDSOR JACOBS, J.P. | Councillor J. ROBINSON, L.R.C.P.

Secretaries.

T. ANSTEY-CHAVE, M.B. | G. NEALE, L.R.C.P., J.P.

Recording Secretary.

H. WILLIAMS, M.D., D.P.H., LONDON.

This Conference is open to all Members and Officials of Port Sanitary Authorities.

Medical Officers of Health.

Thursday, July 16th, to be held in THE LAW COURTS.

President.

E. WALFORD, M.D., D.P.H., Medical Officer of Health, Cardiff.

Vice-Presidents.

F. T. BOND, B.A., M.D., F.R.S.E.
D. S. DAVIES, M.D., D.P.H.
A. DUNCAN, M.B., C.M., D.P.H.
J. HOWARD-JONES, M.D., C.M., D.SC.
J. D. JENKINS, M.D., B.S., D.P.H.
J. MIDDLETON MARTIN, B.A., M.D., D.P.H.
D. J. MORGAN, M.A., M.D., D.P.H.
C. D. MUSGROVE, M.D.
R. PRICHARD, M.D., D.P.H.
W. H. SYMONS, M.D., D.P.H.
T. W. THOMAS, M.R.C.S.
W. WILLIAMS, M.A., M.D., D.P.H.

Secretaries.

HERBERT JONES, L.R.C.S.I., D.P.H. | R. PRICHARD, M.D., D.P.H.
T. W. THOMAS, M.R.C.S.

Recording Secretary.

A. WELLESLEY HARRIS, M.R.C.S., D.P.H., LEWISHAM.

This Conference is open to all Medical Officers of Health.

Engineers and Surveyors to County and other Sanitary Authorities.

Tuesday, July 14th, to be held in THE ENGINEERS' INSTITUTE.

President.

A. E. COLLINS, M.INST.C.E., City Engineer, Norwich.

Vice-Presidents.

G. BELL, ASSOC.M.INST.C.E.
W. NISBET BLAIR, M.INST.C.E.
T. F. HARVEY, ASSOC.M.INST.C.E.
THOMAS MOULDING, ASSOC.M.INST.C.E.
J. C. PARDOE, ASSOC.M.INST.C.E.
JAMES PATON.
G. A. PHILLIPS, ASSOC.M.INST.C.E.
J. S. PICKERING, M.INST.C.E.
C. H. PRIESTLEY, M.INST.C.E.
R. READ, ASSOC.M.INST.C.E.
P. R. A. WILLOUGHBY, ASSOC.M.INST.C.E.
R. O. WYNNE-ROBERTS, M.INST.C.E.
R. H. WYRILL, M.INST.C.E.

Secretaries.

W. HARPUR, M.INST.C.E. | R. H. HAYNES, M.INST.C.E.

Recording Secretary.

E. G. MAWBEY, M.INST.C.E., LEICESTER.

This Conference is open to all Municipal and County Engineers.

Veterinary Inspectors.

Friday, July 17th, to be held in THE LAW COURTS.

President.

Prof. J. PENBERTHY, F.R.C.V.S.

Vice-Presidents.

P. T. B. BASSETT, M.R.C.V.S.
W. T. EDWARDS, M.R.C.V.S.
E. PHILIP EVANS, M.R.C.V.S.
D. G. DAVIES, M.R.C.V.S.
R. W. HALL, M.R.C.V.S.
F. C. HOBBS, M.R.C.V.S.
P. J. MULLANE, M.R.C.V.S.
JOHN L. PERRY, M.R.C.V.S.
A. C. STEWART, M.R.C.V.S.
J. TEMPLE, M.R.C.V.S.
W. R. WILLIAMS, F.R.C.V.S.

Secretaries.

P. J. MULLANE, M.R.C.V.S. | JOHN L. PERRY, M.R.C.V.S.

Recording Secretary.

J. A. DIXON, M.R.C.V.S., LEEDS.

This Conference is open to all Members of the Veterinary Profession.

Sanitary Inspectors.

Wednesday, July 15th, to be held in THE CITY HALL.

President.

G. H. ANDERSON, Chairman, Central Executive Council, Sanitary Inspectors' Association.

Vice-Presidents.

LLEWELLYN DAVIES.
R. J. DAVIES.
D. JENKINS.
DAVID J. JOHNS.
SPENCER E. JONES.
T. MEAZEY.
J. TOWY-THOMAS.
T. W. WARREN.

Secretaries.

G. THOMAS. | D. T. WILLIAMS.

Recording Secretary.

ISAAC YOUNG, BATTERSEA.

This Conference is open to all Sanitary Inspectors and Inspectors of Nuisances.

Women on Hygiene.

Thursday, July 15th, to be held in THE LAW COURTS.

Hon. President.
THE COUNTESS OF PLYMOUTH.

President.
THE LADY MAYORESS OF CARDIFF.

Vice-Presidents.

THE MARCHIONESS OF BUTE.
MISS E. C. ABBOTT, M.A.
MISS M. COLLIN, B.A.
MISS HESTER DAVIES.
MISS M. EVANS.
MRS. S. GRAYSON.
MISS E. GRAHAM HAGERTY.
MISS L. M. HAY.
MISS OLIVE MAY.
MRS. J. MELVILLE-ALISON.
MISS L. M. MORGAN.
MRS. J. ROBINSON.
MISS A. RULE.
MRS. H. THOMPSON.
MISS E. A. MONT WILSON.

Secretaries.
MISS M. E. PEARSON. | MISS E. A. MONT WILSON.

Recording Secretary,
MISS E. P. HUGHES.

This Conference is open to all Ladies interested in Domestic Hygiene.

The Hygiene of School Life.

Wednesday, July 15th, to be held in THE LAW COURTS.

President.
E. H. GRIFFITHS, M.A., SC.D., F.R.S., Principal, University College of South Wales and Monmouthshire.

Vice-Presidents.

MRS. C. CANTILLON.
Councillor D. E. CANTILLON, M.D.
Councillor J. CHAPPELL, J.P.
W. BRYN DAVIES, F.E.I.S.
I. VAUGHAN EVANS.
MISS E. P. HUGHES.
JOHN J. JACKSON, F.A.
JOHN JAMES, M.A., PH.D.
Prof. MILLICENT MACKENZIE.
Alderman LEWIS MORGAN.
Councillor E. NICHOLL.
THOS. POWELL.
H. PRICE, M.A.
F. E. REES, B.SC.
Councillor J. STANFIELD.
Councillor H. M. THOMPSON, M.A.
Councillor H. C. VIVIAN.

Secretaries.
MISS E. G. HAGERTY. | E. C. WILLMOTT.

Recording Secretary.
Miss A. RAVENHILL, LONDON.

This Conference is open to all interested in the subject.

Order of Proceedings.

MONDAY, JULY 13TH.

1 p.m.—Reception of Members and Delegates in the City Hall, by the Right Hon. The Lord Mayor (Councillor Illtyd Thomas, J.P.)

1.30 p.m.—Public Luncheon in the Assembly Room, City Hall (Tickets 3/6). The Right Hon. The Lord Mayor will preside.

3 p.m.—Opening of the Health Exhibition in the Exhibition Pavilion, Cathays Park, by the Right Hon. The Lord Mayor (Councillor Illtyd Thomas, J.P.)

7 p.m. to 8 p.m.—Reception of the Members of the Congress in the City Hall, by the Right Hon. The Lord Mayor and Lady Mayoress (Miss Deanie Thomas).

8 p.m.—Inaugural Address to the Congress, in the City Hall, by the Right Hon. Earl of Plymouth, P.C., C.B., D.L., J.P.

TUESDAY, JULY 14TH.

10 a.m.—Meeting of Section I. (Sanitary Science and Preventive Medicine); Conferences of Municipal Representatives, and Engineers and Surveyors to County and other Sanitary Authorities, in the Law Courts, City Hall, and Engineers' Institute. *(See pages 119, 120, and 121.)*

Excursions.

Visit to the Llandaff and Dinas Powis Infectious Disease Hospital, and to the Cardiff Sanatorium. Limited to 100.

Visit of inspection to the Barry Docks, Barry Smallpox Hospital, Refuse Destructor, etc. Limited to 50.

Excursion to Minehead by Steamer. It is also proposed to arrange visits to Ely Paper Mills, Cardiff, Cardiff Mental Hospital, Parknewydd Sewage Farm, Abercynon, and Excursion to Caerwent.

WEDNESDAY, JULY 15TH.

10 a.m.—Meetings of Section II. (Engineering and Architecture; Section I. (Sanitary Science & Preventive Medicine); Conferences on Hygiene of School Life and Sanitary Inspectors, in the Law Courts and City Hall. *(See pages 119, 122, and 123.)*

3.30 p.m.—Garden Party at St. Fagan's Castle, at the invitation of The Right Hon. The Earl of Plymouth, P.C., C.B., D.L., J.P. (President of the Congress).

8.30 p.m.—Lecture to the Congress, in the City Hall.

THURSDAY, JULY 16TH.

10 a.m.—**Meetings of Section II. (Engineering and Architecture); Conferences of Medical Officers of Health and Women on Hygiene, in the Law Courts.** *(See pages 119, 121, and 123.)*

8 p.m.—**Conversazione and Reception in the Assembly Room, City Hall, at the invitation of Councillor James Robinson, L.R.C.P. (Chairman of the Local Committee).**

Excursions.

Visits to the local Reservoirs and Filter Beds of the Cardiff Corporation Waterworks at Penylan (where the Municipal Observatory and Climatological Station are situated), and the Llanishen and Lisvane Storage Reservoirs. Limited to 50.

Visit to the Cardiff Infirmary.

Visit of inspection to the Cardiff Bute Docks. Limited to 40.

Afternoon trip by Steamer to Clevedon. It is also proposed to arrange visits to Royal Hamadryad Seamen's Hospital, Cardiff. Cardiff Dowlais Works, Cardiff Corporation Electric Power Station, New University College Buildings, and Excursion to Castell Coch and Caerphilly Castle.

FRIDAY, JULY 17TH.

10 a.m.—**Conference of Port Sanitary Authorities and Veterinary Inspectors, in the Law Courts.** *(See pages 120 and 122.)*

1.30 p.m.—**Closing Meeting in the City Hall.**

3.30 p.m.—**Garden Party at Llantarnum Abbey, at the invitation of Sir Clifford J. Cory, Bart., J.P., M.P. (Chairman of Reception and Hospitality Committee).**

8.0 p.m.—**Popular Lecture, by Prof. E. J. McWeeney, M.A., M.D., D.P.H., on "The Prevention of Consumption."**

SATURDAY, JULY 18TH.

Excursions.

Visits of inspection to Cambrian Colliery; limited to 50. Lewis Merthyr Colliery; limited to 50. Cardiff Corporation Waterworks, Brecon Beacons; limited to 50. Visit to Flat Holme Island to inspect Cardiff Port Sanitary Authority's Isolation Hospital and Crematorium; limited to 50. Excursion to Chepstow Castle and Tintern Abbey. Excursion to Ilfracombe by Steamer. Excursion to Hereford to inspect municipal undertakings.

[*Full particulars will be given in Local Programme.*]

The following Set Subjects have been arranged for Discussion in:

Section I.—Sanitary Science and Preventive Medicine.

"Medical Inspection of School Children," to be introduced by H. Meredith Richards, M.D., B.Sc., M.O.H., Croydon, and Philip Boobbyer, M.D., M.S., M.O.H., Nottingham.

Section II.—Engineering and Architecture.

"Street and City Planning," to be introduced by W. Harpur, M.Inst.C.E., City Engineer, Cardiff, Raymond Unwin, and H. Mitchell Whitley, M.Inst.C.E.

Conference of Municipal Representatives.

"Notification of Births," to be introduced by A. K. Chalmers, M.D., D.P.H., Medical Officer of Health, Glasgow.

"Construction and Management of Crematoria," to be introduced by C. Killick Millard, M.D., D.Sc., Medical Officer of Health, Leicester.

Conference of Port Sanitary Authorities.

"Sanitation of the Passenger and Mercantile Marine, especially larger Vessels," to be introduced by F. M. Williams, D.P.H.Camb., Medical Officer of Health, Borough and Port of Plymouth.

Conference of Medical Officers of Health.

"Regulations affecting Transit and Sale of Food," to be introduced by

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Conference of Engineers and Surveyors.

"Best Method of Mixing and Laying Tar Macadam for Street and Main Roads," to be introduced by John S. Brodie, M.Inst.C.E., Borough Engineer and Surveyor, Blackpool.

"Utilisation Residuals from Refuse Destructors," to be introduced by H. PERCY BOULNOIS, M.Inst.C.E., and W. J. STEELE, Assoc.M.Inst.C.E., Deputy City Engineer, Bristol.

"Tree Planting in Streets," to be introduced by C. CHAMBERS SMITH, Engineer and Surveyor, Sutton Urban District Council, and W. H. PETTIGREW, Head Gardener, Cardiff Corporation.

Conference of Veterinary Inspectors.

"Meat and Milk in their relation to Animal Tuberculosis," to be introduced by J. W. BRITTLEBANK, M.R.C.V.S., and A. WATSON, M.R.C.V.S.

Conference of Sanitary Inspectors.

"Is the increasing tendency of Sanitary Authorities to appoint Sanitary Inspectors to discharge special duties an advantage to the community as against an Inspector being assigned to a smaller district and discharging the entire duties of a Sanitary Inspector in that district"?

(*a*) Under the Public Health Acts.

(*b*) Under the Factory and Workshops Acts.

(*c*) Under the Sale of Food and Drugs Acts.

(*d*) Generally.

To be introduced by HENRY JOHNSON, Chief Sanitary Inspector, Wimbledon.

Conference of Women on Hygiene.

"Spring Cleaning and its Sanitary Significance," to be introduced by

Conference on the Hygiene of School Life.

"The Sorting and Grouping of School Children for Educational Purposes," to be introduced by C. J. THOMAS, M.D., B.Sc., D.P.H.

THE HEALTH EXHIBITION

WILL BE HELD IN

CARDIFF,

From JULY 13th to 22nd, 1908.

The Exhibition is held in connection with the Twenty-fourth Congress of The Royal Sanitary Institute, and includes Sanitary Apparatus and Appliances, and Articles of Domestic Use and Economy.

The Principal Boroughs throughout the Kingdom have appointed Delegates to the Meeting, in addition to the Members and ordinary visitors, so that the Exhibits will be brought under the notice of Members of Corporations and Officials from all parts of the country.

The Exhibition will be arranged in the Exhibition Pavilion, situated in Cathays Park, Cardiff.

Applications for Space must be made on the Official Form and under the proper Class. They must be sent to the Curator of the Exhibition at the Offices of the Institute, Margaret Street, London, W., not later than SATURDAY, JUNE 13TH, but it is advisable that much earlier application should be made.

The Scale of Charges for Floor Space will be 30s. per Foot frontage in the Main Avenue, with a depth of ten feet; in Side Avenues, six feet deep, with two frontages, 25s., and with one frontage, 15s. Wall space, 1s. per square foot. No Floor space will be allotted for less than three feet frontage, or Wall Space for less than five square feet. *All charges must be paid at the time of Allotment.*

Silver and Bronze Medals will be awarded at the discretion of the Judges, and their decisions will in all cases be final. A complete Classified and Illustrated List of Exhibits, to which Awards have been given by the Institute, is published by the Institute.

Special Medal.—A Special Medal will be awarded for Household Sanitary Appliances in case of pre-eminent merit, which will be called the ROGERS FIELD MEDAL.

Protection in accordance with the Patents, Designs, and Trade Marks Act, 1883, will be obtained from the Board of Trade for persons desirous of exhibiting New Inventions.

Forms of Application for Space and other particulars can be obtained at the Offices of the Institute, Parkes Museum, Margaret Street, London, W.

THE ROYAL SANITARY INSTITUTE.

ARTICLES RELATING TO PUBLIC HEALTH,*

Appearing in the chief British and Foreign Journals and Transactions.

Abstracts of Titles classified in this List under the following headings:—

Science in Relation to Hygiene and Preventive Medicine.
Hygiene of Special Classes, Trades, and Professions; and Municipal Administration.
Building Materials, Construction, and Machinery.
Water Supply, Sewerage, and Refuse Disposal.
Heating, Lighting, and Ventilating.
Personal and Domestic Hygiene.

The articles referred to in this list are as far as possible collected and filed in the Library of the Institute for the use of the Members and Associates.

Hygiene of Special Classes, Trades, and Professions; and Municipal Administration.

Blanc, Hippolyte J., R.S.A., F.R.I.B.A. Bangour Village Asylum (illustrated). *Journal of the R.I.B.A.*, March 16th, 1908, p. 309.

A description of an asylum erected by the Edinburgh Parish Council upon 150 acres of land about fifteen miles from the city, having its own water supply and its independent system of drainage in duplicate.

Haldane, Dr. J. S. The Removal of Dust and Fumes in Factories. *Journ. Roy. Soc. Arts*, Vol. lvi., No. 2896, 1908, pp. 675–688.

Deals also with mines. The headings are:—Prevention of Dust Formation; Prevention of Escape of Dust; Removal of Dust; Arrangement of Ducts for Exhausting Air. Fans employed in removal of Dust: Exhaust Arrangements.

Seager, S. Hurst, F.R.I.B.A. Safety Exits for Theatres and other places of Entertainment. *Journal of the R.I.B.A.*, Jan. 11th, 1908, p. 159.

A very interesting and suggestive paper, showing how exit from public buildings may be facilitated by special arrangements of corridors and passages to avoid crushing.

Slater, John, F.R.I.B.A. Report upon the 14th International Congress of Hygiene and Demography at Berlin. *Journal of the R.I.B.A.*, Oct., 1907, p. 710.

A Report to the Institute from its representative at the Congress, pointing out that the medical side of hygiene was much more prominent than the architectural.

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* Members or Associates wishing to file or catalogue these Titles can, on application, be supplied with excerpt copies for this purpose.

WOODWARD, WILLIAM, F.R.I.B.A. Recent Fire Legislation for London under the Factory and Workshop Acts, 1895 and 1901; the London Building Act, 1904: and the London Building Acts (Amendment) Act, 1905. *Journal of the R.I.B.A.*, Dec. 16th, 1907, p. 117.

An able criticism of the clauses of these Acts from an Architect's point of view.

MEETINGS HELD.

SESSIONAL MEETINGS.

London, June 13th.—The meeting was held in the Parkes Museum, when a discussion on "The Pasteurisation of Milk" was opened by Prof. H. R. Kenwood, M.B., D.P.H., Medical Officer of Health, Stoke Newington. The chair was taken by Col. J. Lane Notter, M.A., M.D., R.A.M.C., Vice-Chairman of the Council. In the afternoon a visit was made to the Sudbury Park Dairy Farm and the Walker Gordon Laboratories, by invitation of Mr. and Mrs. G. Titus Barham, who entertained the Members at a Garden Party.

Coventry, June 20th.—The meeting was held in the St. Mary's Hall, Coventry, when a discussion on "Some Aspects of the Housing Problem and Town Planning" was opened by E. H. Snell, M.D., B.Sc., D.P.H., Medical Officer of Health, and J. E. Swindlehurst, M.Inst.C.E., City Engineer. The chair was taken by H. D. Searles-Wood, F.R.I.B.A., Chairman of Council of the Institute. Visits were made to places of interest in the city and to Kenilworth Castle, where His Worship the Mayor entertained the members at Tea.

EXAMINATIONS.

The following Examinations have been held:—

Sanitary Science as applied to Buildings and Public Works.

Manchester, June 19th and 20th. 4 Candidates; 1 Certificate granted.

Hygiene in its Bearing on School Life.

Manchester, June 19th and 20th. 7 Candidates; 2 Certificates granted.

Women Health Visitors and School Nurses.

Manchester, June 19th and 20th. 2 Candidates; no Certificate granted.

Inspectors of Nuisances.

Dublin, June 12th and 13th. 8 Candidates; 2 Certificates granted.
Manchester, June 19th and 20th. 55 Candidates; 23 Certificates granted.

Inspectors of Meat and other Foods.

London, May 29th and 30th. 43 Candidates; 26 Certificates granted.

Candidates who have received Certificates.

Sanitary Science as applied to Buildings and Public Works.

Bailey, Thomas Richard.

Hygiene in its Bearing on School Life.

Gardner, Margaret. Griffiths, Dora.

Inspectors of Nuisances.

Adcock, George Henry.
Barclay, Florence.
Bateman, Arthur.
Bower, Martha.
Carter, Atkin Smith.
Cowley, George William.
Dyson, John William.
Farnell, William Robert.
Fletcher, Thomas Drinkwater.
Forster, Charlotte Margaret Haire.
Holden, William Arthur.
Leach, William.
Lendon, Herbert.
Lord, Bessie.
Middleton, Harry.
Pascoe, Rose Wells.
Perks, Walter Richard.
Richardson, Maud Augusta.
Ryan, Minnie.
Selby, James William.
Sewell, Thomas.
Sumner, Henry.
Tate, John William.
Toledano, Stella E.
Winterbottom, Arthur.

Inspectors of Meat and other Foods.

Atkins, Alban Crofton, *Major, A.S.C.*
Baker, Benjamin.
Barnes, William.
Barnett, Fred.
Cunningham, William Meldrum.
Davis, Philip.
Gardner, Charles T.
Green, Henry Charles.
Haigh, Tom Vickerman.
Hurst, William Henry James.
Jackson, Albert Arthur.
Jerrom, John Henley Grimley.
Mills, Alfred Thomas.
Monkcom, Henry Charles.
Nunn, Charles Henry Napier, *Capt., A.S.C.*
Over, George Complin.
Peverett, Walter.
Shail, Albert.
Smith, George.
Taylor, Harry Thomas.
Tweed, Charles Casburn.
Watt, William Alexander.
Welman, Arthur Pole, *Major, A.S.C.*
Williams, John Thomas.
Williamson, William Alex. Finiston, *Major, A.S.C.*
Winter, John Ernest.

FORTHCOMING MEETINGS.

Examinations.

In Sanitary Science as applied to Buildings and Public Works, for Inspectors qualifying for membership, in Hygiene in its bearing on School Life, for Women Health Visitors and School Nurses, and for Inspectors of Nuisances.

Birmingham, July 3rd and 4th.

For Inspectors of Meat and other Foods—

Leeds, July 24th and 25th.

CALENDAR, JULY, 1908.

As far as at present arranged.

3 F. } Examinations—Birmingham.
4 S. }

13—22. **Congress and Exhibition, Cardiff.**

24 F. } Examination for Inspectors of Meat and Other Foods, Leeds.
25 S. }

BILLS BEFORE PARLIAMENT.

The Council have considered the following Bills, which are now before Parliament, and the action taken is noted in each case:—

Children. Ordered to be brought in by Mr. Herbert Samuel and Mr. Secretary Gladstone.

A Bill to consolidate and amend the law relating to the protection of children and young persons. It contains sections dealing with infant life protection, prevention of cruelty to children and young persons, juvenile smoking, reformatory and industrial schools, juvenile offenders, etc.

A petition was sent in favour of this Bill.

Dairies (Scotland). Presented by Mr. Gulland, supported by Sir John Tuke, Mr. Cleland, Mr. M'Callum, Mr. Findlay, Mr. Sutherland, Mr. Barnes, Mr. M'Crae, Mr. Younger, Mr. Menzies, Mr. Wilkie, and Mr. Esslemont.

A Bill to consolidate the law as to dairies in Scotland; to provide for the registration of dairymen and for the inspection of dairies and cows, and to give local authorities power to regulate the milk supply.

A petition was sent in favour of this Bill.

Infant Life Protection. Presented by Mr. Staveley Hill, supported by Mr. Lee, Mr. Hay, Mr. Hills, Mr. Ramsay Macdonald, and Mr. Nicholls.

A Bill to extend the provisions of the Infant Life Protection Act, 1897, to cases where only one child is taken to be nursed or maintained, and to provide for more efficient protection and supervision of such children.

A petition was sent in favour of this Bill.

Metropolitan Sewers and Drains. Presented by Mr. Dickinson, supported by Sir William Bull, Mr. Bowles, Sir William Collins, Mr. Crooks, Mr. Timothy Davies, Sir George Fardell, Mr. Claude Hay, Sir Henry Kimber, Earl Percy, Sir Albert Spicer, and Mr. Waterlow.

A Bill to amend the state of the law relating to combined drainage.

A petition was sent in favour of this Bill.

Public Health. Presented by Mr. Cooper, supported by Sir Walter Foster, Mr. Bowerman, Mr. Crooks, and Mr. Straus.

A Bill to make the council of an administrative county the predominant sanitary authority of such county, and to give it power to supersede any local authority in the county which may neglect or refuse to carry out any of its statutory duties. The Bill provides for the appointment of county medical officers of health, and deals with the question of the qualifications of medical officers of health and sanitary inspectors, and the question of tenure of office.

A petition was sent in favour of this Bill.

Public Health Act (1875) Amendment (Water Rights). Presented by Mr. Leif Jones, supported by Mr. Brace, Mr. Helme, Viscount Helmsley, Mr. M'Crae, Mr. Nicholls, Mr. Charles Roberts, Mr. Shackleton, Mr. Soares, and Mr. Luke White.

A Bill to empower local authorities to acquire water rights, within or without their district, otherwise than by agreement.

A petition was sent in favour of this Bill.

Public Health Officers. Presented by Sir Walter Foster, supported by Sir John Tuke, Sir Francis Powell, and Mr. Cooper.

A Bill to ensure that none but those properly qualified shall be appointed as medical officers of health or sanitary inspectors, and to give such officers and inspectors security in their tenure of office.

A petition was sent in favour of this Bill.

Housing, Town Planning, etc. Presented by Mr. Burns, supported by Mr. Attorney-General, the Lord Advocate, and Dr. Macnamara.

A Bill to amend the law relating to the housing of the working classes; to provide for the making of town-planning schemes; and to make further provisions with respect to the appointment and duties of county medical officers of health.

The following notes upon the Bill were sent to a member of Parliament, with the request that he should lay them before the Committee of the House of Commons when the clauses of the Bill were being considered:—

On clause 57.—The Institute agree to the principle embodied as to the compulsory appointment of county medical officers of health, and they look forward to an increase in the duties of such officers, and a strengthening of their power.

On clause 58, sub-section 2.—The Institute consider that as the new duties imposed by this section will further jeopardise the position of many district medical officers of health, their tenure of office should be made more secure.

Generally on the Bill. The Institute consider that owing to the large amount of work devolving upon the Local Government Board, it is desirable that there should be as far as possible a tendency to extend the powers of county councils in the carrying out of the Housing and Town Planning Act.

Home Work Regulation. Presented by Mr. Ramsay Macdonald, supported by Mr. George Roberts, Mr. Edmund Lamb, Sir Gilbert Parker, Mr. Wedgwood, Mr. Bennett, Mr. Pirie, Mr. Seddon, Mr. Thomas Corbett, Mr. Mitchell-Thomson, and Mr. Fenwick.

A Bill to provide for the better regulation of home industries by the certification of all persons to whom work is given to be done at their own homes.

A petition was sent against this Bill, on the same grounds as those set out last year.

The following Bills were also considered, but no action was thought desirable:—

Housing of the Working Classes Acts Amendment.

Housing of the Working Classes.

Housing of the Working Classes (Ireland).

Nurses (Registration).

Nurses Registration (No. 2).

Sale of Food and Drugs Acts (Amendment) (Scotland).

LIST OF MEMBERS AND ASSOCIATES ELECTED,

JUNE, 1908.

MEMBERS.

Marked thus have passed the Examination of the Institute in Sanitary Science as applied to Buildings and Public Works.

‡ Marked thus have passed the Examination for Inspectors of Nuisances.

Reg. No.	Date of Election.	
2161	1908. June.	BAILLIE, Charles Edward Cecil, ASSOC.M.INST.C.E., 29, *Oxford Gardens, N. Kensington.*
2162	1908. June.	BENNETT, Edward Henry, *Uttoxeter New Road, Derby.*
2163	1908. June.	*BENNETT, Malcom Beresford, 15, *Powis Square, Brighton.*
2164	1908. June.	*BROWN, Robert, *Monk Hall Farm, Worsthorne, near Burnley.*
2165	1908. June.	*BROWN, William Alfred, *Woodside, Pollards Hill North, Norbury, S.W.*
2166	1908. June.	BRUCE, Charles William, ASSOC.M.INST.C.E., 58, *Carden Place, Aberdeen.*
2167	1908. June.	BRYCESON, Arthur B., *Town Clerk, Town Hall, Woolwich.*
2168	1908. June.	‡DALZELL, Arthur George, *General Delivery, Vancouver, British Columbia, Canada.*
2169	1908. June.	‡*DOW, Thomas Cramp, 2, *Newhaven Road, Leith.*
2170	1908. June.	ELDER, Miss Elizabeth F., M.B., CH.B., 58, *Stacey Road, Cardiff.*
2171	1908. June.	*FARRER, Frederick Robert, F.S.I., 2, *Coleman Street, E.C.*
2172	1908. June.	GRIMWOOD, George Francis, *Borough Engineer, &c., Monmouth.*
2173	1908. June.	*HARRINGTON, Wilfred William, 19, *Trevor Square, Knightsbridge, S.W.*
2174	1908. June.	HAYES, Harold St. George Bown, ASSOC.M.INST.C.E., 42, *Strathearn Road, Wimbledon Park, S.W.*
2175	1908. June.	HODSON, Laurence, S., F.A.S.I., 223, *Seven Sisters Road, Finsbury Park, N.*
2176	1908. June.	HUTCHINSON, James Randal, M.B., CH.B., D.P.H.VICT., *Public Health Offices, Town Hall, Manchester.*
2177	1908. June.	JACK, Gavin Heynes, *County Surveyor, The Shire Hall, Hereford.*
2178	1908. June.	JOHNSON, Harry, F.C.I.S., *House Governor and Secretary, The Leicester Infirmary, Leicester.*
2179	1908. June.	*KHOSLA, Ratan Chand, B.A., 13, *Gipsy Hill, Upper Norwood.*
2180	1908. June.	‡*KINCH, Maurice Whinley, 1, *Allison Road, Acton.*
2181	1908. June.	LINTON, Stanley F., M.B., B.SC., *Senior Assistant Medical Officer, Monsall Hospital, Manchester.*

Reg. No. Date of Election.

2474 1908. June. MATTHEW, Stanley, *South Villa, Crow Nest Park, Dewsbury.*

2469 1908. June. *NUNN, Lewis Edgar, 425, *Edgware Road, W.*

2473 1908. June. POWELL, Joshua, M.R.C.S., L.S.A. (*M.O.H.*), *Adpar, Newcastle Emlyn, South Wales.*

2470 1908. June. *QUIGLEY, John, Junr., 22, *Lauriston Place, Edinburgh.*

2491 1908. June. *ROGERS, William Julius Claxton (*Sanawar, Punjab, India*), *c/o Thos. Cook & Son, Ludgate Circus, E.C.*

2478 1908. June. ROTH, Colonel Reuter Emerich, M.R.C.S.ENG., 52, *College Street, Sydney, Australia.*

2492 1908. June. *SELF, Sidney Arthur, 18, *Dalmeny Road, Tufnell Park, N.*

2477 1908. June. STEDMAN, Thomas Bernard, M.D.LOND., D.P.H.CAMB. (*M.O.H.*), *Selby, Yorks.*

2474 1908. June. TIMOTHY, Ernest, ASSOC.M.INST.C.E., 24, *Woodland Road, Upper Norwood, S.E.*

2479 1908. June. VENNING, Harry John, A.R.I.B.A., P.A.S.I., 19, *Hanover Square, W.*

2480 1908. June. WILLIAMS, Frederick Mann, L.R.C.P.EDIN., L.M., M.R.C.S., D.P.H.CAMB. (*M.O.H.*), *Municipal Offices, Plymouth.*

ASSOCIATES.

‡ Marked thus have passed the Examination for Inspectors of Nuisances.

S Marked thus have passed the Examination in Practical Hygiene for School Teachers.

| Marked thus have passed the Examination for Women Health Visitors and School Nurses.

M Marked thus have passed the Examination for Inspectors of Meat and Other Foods.

4444 1908. June. ‡ARNOLD, Miss Frances, *Governor's House, H.M. Prison, Lancaster.*

4445 1908. June. ‡BLAND, Samuel Patrick, *Kilburnie, Hythe, Kent.*

4446 1908. June. ‡BORGARS, William Henry, 8, *Oval Road, Regent's Park, N.W.*

4480 1906. Jan. ‡BRAIN, Albert H., *Council Offices, Kingswood, Bristol.*

4447 1908. June. ‡BROCKLEBANK, Miss Olive, 20, *Myton Gate, Hull.*

4448 1908. June. *S* BRUHL, Mrs. Alice, *Triplow, Romford, Essex.*

4441 1908. June. CHASSEAUD, John, *Chief Assistant Engineer, M.D.D., Cairo, Egypt.*

4449 1908. June. ‡CHUBB, Frederick E., 6, *Old Priory, Plympton, Devon.*

4450 1908. June. ‡CLAPSON, Herbert William, 159, *High Street, Deptford.*

4451 1908. June. ‡DENT, Miss Ethel Augusta, *Ousegate School, Selby, Yorks.*

4452 1908. June *S* DINSDALE, Miss Annie, *Barleycote, near Keighley, Yorks.*

4453 1908. June. ‡DREW, John Henry, *Town Hall, Horbury, Yorks.*

4454 1908. June. ‡GOUNDRY, Walter Edwin, 55, *Horsford Road, Brixton Hill, S.W.*

Reg. No. Date of Election.

1455 1908. June. ‡Haysey, William Lewis. *The Glen, Harringay Park, Crouch End, N.*

1456 1908. June. Hogbin, Percy James Kirkham, 39, *Dour Street, Dover.*

1457 1908. June. ‡Jackson, John William, 22, *Milner Street, Acomb, York.*

1458 1908. June. Jaffa, Marcus, 112 & 114, *High Street, Deptford, S.E.*

1484 1903. Oct. ‡James, W. D., *Springfields, Pontardulais, Glam.*

1459 1908. June. ‡Johnson, Percy Alfred, *The Lodge, Bonner Hill Road, Kingston, Surrey.*

1460 1908. June. ‡Lee, Alfred, *District Council Offices, Southall.*

1461 1908. June. § Letters, Miss Fanny Riordan, 3, *Callow Street, South Kensington, S.W.*

1462 1908. June. § Lovegrove, Miss Rose, 28, *Cassland Road, Thornton Heath.*

1463 1908. June. ‡Luck, George E., 28, *St. John's Church Road, Folkestone.*

1464 1908. June. § Macdonald, Miss Isabella, *Balado, Kinross, N.B.*

1465 1908. June. ‡Menon, Chittayil Parameswara (*Ernakulam, Cochin State, India*), 1, *St. Luke's Road, Bayswater, W.*

1466 1908. June. ‡Mitchell, George Edwin, *Ashen Road, Clare, W. Suffolk.*

1467 1908. June. ‡Mitchell, George William, *Prospect Place, Pocklington, Yorks.*

1468 1908. June. ‡Murray, Michael Joseph, *Sanitary Inspector, Rangoon, Burma.*

1469 1908. June. ‡Paterson, George, *Eastfield Farm, Penicuik, Midlothian.*

1470 1908. June. ‡Phillips, Joseph Heathfield, 35, *Berners Street, Ipswich.*

1471 1908. June. ‡Pike, John Percy, 35, *Kimberley Road, Stockwell, S.W.*

1472 1908. June. Pixell, Miss Helen Lucia Mary, B.Sc., *St. Faith's Vicarage, Stoke Newington, N.*

1473 1908. June. ‡Salmon, Frederick Charles, 1, *James Street, Iffley Road, Oxford.*

1474 1908. June. Smart, Miss Winifred C., 52, *Norfolk House Road, Streatham, S.W.*

1475 1908. June. ‡Smith, Albert Edward, *Godstone Villa, Viewsley, Middlesex.*

1476 1908. June. ‡Spickett, T. L., *Council Offices, Barry, Glam.*

1477 1908. June. ‡Whitehouse, Thomas, 1, *New Road, Rainhill, Lancs.*

1478 1908. June. ‡Whipp, Alfred Herbert, 23, *Kerrison Road, Battersea, S.W.*

1479 1908. June. ‡Woodhall, Percy C., *The Laurels, Harrow View, Wealdstone, Middlesex.*

1480 1908. June. ‡Yorke, John, *Station Road, Brierley Hill, Staffs.*

1481 1908. June. § Young, Miss Agnes Siddons, *Dinecraft, Kinross, N.B.*

THE ROYAL SANITARY INSTITUTE.

REVIEWS OF BOOKS.

MANCHESTER CORPORATION: THE CITY SURVEYOR'S MEMORANDUM OF VELOCITIES AND DISCHARGES OF A CIRCULAR SEWER, ETC.

This may truly be called a monumental work; it represents the embodiment of an aspiration that affects all engineers at some time or other, namely, to produce a set of tables and diagrams that shall for ever do away with the necessity for further calculation. Each section has the modest title of a "Memorandum," but the whole work consists of a bound folio three inches thick. It contains tables and graphic diagrams showing the velocity and discharge at every inch in depth in pipe sewers 4 in. to 3 ft. diameter, at a complete series of gradients. Similar information is given regarding circular brick sewers from 2 ft. to 10 ft. diameter, and standard egg-shaped brick sewers from 2 ft. 6 in. by 1 ft. 8 in. to 6 ft. by 4 ft. The formulæ by which the tables have been compiled are given together with the coefficients, and instructions for the conversion of tables calculated by one coefficient of friction to the corresponding values for any other coefficient. Some useful hydraulic memoranda bring the tables to a close. It does not appear that this work is obtainable by the public, but its presence in every municipal and sanitary engineer's office would be hailed with satisfaction by those who have now to make their calculations over and over again. H. A.

LABOUR AND CHILDHOOD.*

"Hygiene in education" is the keynote struck by this little book, which sings the right song all the way through; and though the accompaniment is often laboured, borrowed, and overstrained, the meaning of the song is original and clear.

The doctor's real work in school, writes the author, does not consist in the mere dealing with questions of sanitation and the prevention of infection. His real work is concerned with the healthy organism of childhood. His goal is education, not the mere checking of infection and disease.

A child's play comes first in the preservation of the healthy organism. The doctor's need of training before he can touch this side of his difficult task—play—is told in an anecdote of a great physician, who urged upon a teacher that all little girls should teach themselves hygiene by practising it in play with their dolls. The doctor added naively, "My little girl does it *voluntarily* in washing, dressing, and caring for her doll. I should like all little girls *taught* such play."

Play *taught!*—is not such play merely a new task? Is not play the spontaneity of imagination founded upon experience that deals with memories and not with new ideas, thrust upon a child through its toys? Happy the nation that is supplied with young medical men (why not women?)

* Labour and Childhood, by Margaret McMillan. 205 pp., 8vo. Swan Sonnenschein & Co., Ltd. Price 3s. 6d.

who have graduated in co-educational schools and taken "courses of observation" in their sisters' nurseries before undertaking the medical inspection of schools.

Following play comes work in school: here the doctor's task is more obvious and the training will be easier. To recognise that "if any subject does not invoke power and improve the health of the organisms of the child, it is not worth learning." That "health is a product of right learning: good teaching is founded on physiology."

The acquisition of habits is discussed with wisdom, and shows a knowledge of life; the forming of the habits of cleanliness even as a school practice, unless associated with a home or medical ideal, is shown to be impossible. What is the Cleansing of Persons Act worth with regard to children? Supposing children were seized and washed by law in a specially furnished kind of bath of correction, would such measures form the basis of new habits? As well hope a child might learn to love books by being forced at rare intervals to have a spelling lesson in a police cell.

"Mind in the making" must no longer be rudely interrupted in young children, but they must be allowed "to remain *with wandering mind* on the knees of their good mothers, touching, dreaming in peace, and coming forth from this baptism of emotion thinkers, discoverers, poets, saviours." (*Séguin.*) Then time must be given freely to the school youth that it may grow in deftness, as do the savages by nature's laws; it takes longer to become a man than a beast, a civilised man than a savage. On the pain of limiting all healthy development whatsoever, school life must not hinder the impulse for progressive self-projection; education must give free play to this impulse, and as soon as boys and girls really begin to require instruments (or toys) of work or play they should begin by making something, rude or simple, but, to the child, effective.

That the discrimination of the medical man is needed to gauge the normal child afresh is maintained: a trained mind outside the routine of the teacher's life, apart from legislation.

And not only are the subjects of the curriculum to be reconsidered by the doctor and fitted to the child's life and organism, but the methods are to help his growth. For example, there is hygiene of instruction in mathematics. We know this, because children have been injured physically by learning in the wrong way; and strengthened physically and morally by learning in the right way. Moreover, they hated the wrong movements just as they would hate having their fingers twisted backwards; but they enjoyed the right ones, just as they would enjoy walking and jumping.

It is sometimes asked: "Could not the trained hygiene teacher do all this better than the doctor?" Maybe, if there must be choice of one or the other: but the task is so enormous; the making and administering of educational law is so complicated, the mass of public opinion among parents so conservative of old methods that have become antiquated in the changing conditions of life, that the schools gratefully recognise the help that will be given them by the medical man whose training has covered a wider field than that of medical measures only, and has embraced also the study of the normal condition of the healthy organism of childhood.

I. W. W.

ARTICLES RELATING TO PUBLIC HEALTH,*

Appearing in the chief British and Foreign Journals and Transactions.

Abstracts of Titles classified in this List under the following headings:—

Science in Relation to Hygiene and Preventive Medicine.
Hygiene of Special Classes, Trades, and Professions; and Municipal Administration.
Building Materials, Construction, and Machinery.
Water Supply, Sewerage, and Refuse Disposal.
Heating, Lighting, and Ventilating.
Personal and Domestic Hygiene.

The articles referred to in this list are as far as possible collected and filed in the Library of the Institute for the use of the Members and Associates.

Science in relation to Hygiene and Preventive Medicine.

DUNCAN, F.M. Industrial Entomology: The Economic Importance of a Study of Insect Life. *Journ. Roy. Soc. Arts*, Vol. LVI., No. 2896, 1908, pp. 688–696.

Deals chiefly with malaria and sleeping sickness. Discussion at end.

Hygiene of Special Classes, Trades, and Professions; and Municipal Administration.

ADLER, NETTIE, MISS. Child Workers and Wage Earners. *Journ. Roy. Soc. Arts*, Vol. LVI., No. 2899, 1908, pp. 738–747.

Notes certain conditions in our social order which go against the welfare of children and the steps taken to combat the evil, and suggests further measures. Cotton-trade, shops, street-trading, home industries, agriculture are the subjects treated of.

Water Supply, Sewerage, and Refuse Disposal.

BEADLE, CLAYTON. Some Observations upon the Underground Water Supplies to the Thames Basin. *Journ. Roy. Soc. Arts*, Vol. LVI., No. 2895, p. 656.

Deals with Kent. The headings are: Depletion; Available supplies: Infiltration from Thames; Amount of water pumped; General observations and conclusions. There are appendices and tables giving statistical details of the amount of water pumped in various districts and the areas of permeable beds, etc., in relation to percolation. Discussion at end.

HORTON, THEODORE. Sanitary Patrol of Watersheds. *Engineering Record*, June 20th, 1908, p. 769.

Indicating danger of contamination of water supplies, and recommending systematic inspection.

THOMPSON, SANFORD E. Permeability Tests of Concrete with the addition of Hydrated Lime. *Engineering Record*, June 27th, 1908, p. 806.

Particulars of tests with hydrated lime added to Portland cement concrete to secure water tightness for tanks and reservoirs.

* Members or Associates wishing to file or catalogue these Titles can, on application, be supplied with excerpt copies for this purpose.

MEETINGS HELD.

Congress and Exhibition at Cardiff.

The Twenty-fourth Congress and Exhibition of the Institute was held at Cardiff from July 13th to 18th, 1908.

Very suitable accommodation was provided for the meetings in the City Hall, Law Courts, and Engineers' Institute; and excellent arrangements were made for the reception and convenience of members.

The Exhibition was held in the Exhibition Pavilion, Cathays Park.

The Congress was received by the Rt. Hon. The Lord Mayor (Alderman Illtyd Thomas, J.P.), who formally opened the Exhibition.

The First General Meeting was held on July 13th. The Rt. Hon. The Earl of Plymouth, P.C., C.B., Lord Lieutenant of Glamorganshire, was installed as President of the Congress and delivered his Inaugural Address.

The business of the Congress was divided into two Sections and eight special Conferences; particulars of these are given in the Programme of the Congress in the Supplement to No. 5 of the Journal.

During the Congress 83 Addresses, Lectures, and Papers were read in 15 meetings. The President's Address and the Popular Lecture are published in the current Journal.

The papers read in the Sectional and Conference meetings, with the discussions upon them, will be published in subsequent numbers of the Journal.

During the meeting Excursions were made to Caerwent, Parknewydd Sewage Farm, Barry, Minehead, Flat Holm Island, Taffs Well, Cardiff Bute Docks, Ely Paper Works, Cardiff Mental Hospital, Cardiff Infirmary, Royal Hamadryad Seamen's Hospital, Dowlais-Cardiff Steel Works, Cardiff Waterworks in Breconshire, Lewis Merthyr Collieries, Cambrian Collieries, Llwynpia, Ilfracombe, Chepstow, Tintern, and Hereford.

The members were most hospitably entertained at a Conversazione in the City Hall by the Chairman of the Local Committee, Councillor James Robinson, and at Garden Parties by The Rt. Hon. The Earl of Plymouth, and Sir Clifford J. Cory.

The numbers attending the Congress were as follows: Delegates, 435; Members and Associates of the Institute, 332; Associates of the Congress and other Subscribers, 80; Complimentary and Press, 100; making a total of 947.

Delegates were appointed by 239 Authorities and learned Institutions.

The Closing Meeting.

The Closing Meeting of the Congress was held on Friday, July 17th, Mr. H. D. Searles-Wood, F.R.I.B.A., the Chairman of Council presided.

Reports of work done in the different Sections and Conferences, and the Resolutions passed, were read by the respective Secretaries, and the Resolutions were referred to the Council of the Institute for consideration.

Proposed by the Chairman: seconded by Dr. C. Sanders (West Ham):—

Resolved.—"That The Royal Sanitary Institute and the members of the Congress desire to express their most sincere thanks to the Right Hon. The Lord Mayor and the Lady Mayoress, and to the Corporation of the City of Cardiff, for the cordial manner in which the Congress has been received, and for the personal kindness and hospitality extended to the members."

Proposed by Mr. W. Kaye-Parry, M.Inst.C.E. (Dublin); seconded by Dr. D. S. Davies (Bristol):—

Resolved.—"That the hearty thanks of The Royal Sanitary Institute and of the Congress be presented to the Corporation of the City of Cardiff, and to the Council of the Institute of Engineers, for their courtesy in placing at the disposal of the Congress such appropriate and convenient buildings for the various meetings."

Proposed by Mr. W. Whitaker, F.R.S. (London); seconded by Dr. E. Walford (Cardiff):—

Resolved.—"That the sincere thanks of the members of the Congress be accorded to Sir Clifford J. Cory, Bart., M.P.; to Councillor James Robinson and Mrs. Robinson; Principal Griffiths and others, who placed their motor cars at the disposal of the members; the Merthyr and Aberdare Farms Committee; the Barry Railway Co.; Mr. Edmund Hancock, Junr.; the South Wales and West of England Branch of the Society of Medical Officers of Health; Alderman Robert Hughes, J.P.; Mr. C. H. Priestley; the Committee for the Main Outfall Sewerage Works and the Contractor; the Chairman of the Llandaff and Dinas Powis Rural District Council; Dr. B. W. Broad; the Cardiff Corporation Electricity Committee and Mr. A. Ellis; the Superintendent of the Cardiff Railway Co.; the Proprietors of the Ely Paper Works; the Committee of the Cardiff Mental Hospital and Dr. Goodall; Major-General Lee and Colonel E. M. Bruce-Vaughan; the Committee of the Royal Hamadryad Seamen's Hospital and Dr. Wheelan; the Dowlais-Cardiff Steel Works; the Directors of the Lewis Merthyr Consolidated Collieries, Ltd.; the Directors of the Cambrian Collieries, Ltd.; Dr. Herbert Jones; Miss Olive May, Superintendent of Swedish Drill to the Cardiff Education Committee, and her pupils; and the Committee of the St. John's Ambulance Association, for having so kindly shown hospitality at private receptions at the various excursions, and by privileges accorded to members, which added so greatly to the pleasure and enjoyment of the meeting."

Proposed by Dr. P. Boobbyer (Nottingham); seconded by Dr. J. Spottiswoode Cameron (Leeds):—

Resolved.—"That the earnest thanks of the Congress are due and are hereby accorded to Councillor James Robinson, to the Local General Committee, to the various Sub-Committees, and to the Local Secretaries, for their arduous labours in their several departments, and for their unremitting exertions in carrying out the many details in the organisation of the Congress, which have culminated in a most successful meeting."

Proposed by Councillor Smith (Cardiff); seconded by Dr. A. Wellesley Harris (Lewisham):—

Resolved.—"That the thanks of the meeting are due to the representatives of the press for the reports which have been published of the proceedings, and which are of great service in widening the scope and usefulness of the Congress."

Proposed by The Rt. Hon. The Lord Mayor of Cardiff; seconded by Mr. E. G. Mawbey, M.Inst.C.E. (Leicester):—

RESOLVED.—"That the cordial thanks of the Congress are hereby presented to the President, The Right Hon. The Earl of Plymouth, for the interest and courtesy he has displayed in presiding over the Congress, and to his Lordship and the Countess of Plymouth for the hospitality extended to the members at St. Fagan's Castle, which added such an enjoyable feature to the week of the Congress."

AWARDS MADE AT THE EXHIBITION.

SILVER MEDALS.

BLAKEBOROUGH, J., & SONS.
Boyd's Water-main Drilling and Tapping Apparatus.

BRITISH SANITARY CO.
Self-acting Earth Closet.

BURN BROS.
Cast-iron Drain and Soil-pipe Fittings.

CONSTABLE & SON.
"Perfect" Refuse Collecting Van.

CORNES & HAIGHTON.
Combination Range, Copper, and Bath.

DUCKETT, J., & SON.
"Sabden" Isolated Siphonic Closet Range.

DEFRIES, J., & SONS, LTD.
Equifex Saturated-steam Disinfector with Superheated Dryer.

GODDARD, MASSEY, & WARNER, LTD.
"Lyon Type" Steam Disinfector.

LOVIBOND, JOSEPH W.
Colour Educator.

SLACK & BROWNLOW.
Hospital Filter with Thermometer for providing Sterile Water.

SPENCER, HEATH, & GEORGE, LTD.
Educational Gymnastic Outfits.

WILSON & STOCKALL.
Accident Ambulance.

BRONZE MEDALS

ADAMS-HYDRAULICS, LTD.
Conical Cross-bar Penstocks.

BAYER CO.
Autan Disinfectant.

BENNET FURNISHING CO.
Adjustable School Desk.

BENNET FURNISHING CO.
Portable Platform and Galleries.

BLAKEBOROUGH, J., & SONS.
Screw-down Hydrant, adaptable to Ball Hydrant connection.

BUSH, MRS. FANNY.
Pure Welsh Health-Flannel.

COMBINATION COLLAPSIBLE VENTILATOR CO.
Sash (Automatic Opening) Ventilator.

DANYSZ VIRUS, LTD.
Danysz Virus of recent preparation.
EAGLE RANGE & GAS STOVE CO., LTD.
New Premier Eagle Range.
"ENGLAND" WORKS.
Ball-bearing Door Pivot.
FREEMAN, THOMAS RICHARD.
Washed and Sterilised Flock.
GODDARD, MASSEY, & WARNER, LTD.
Helical Washing Machine.
HOWSON, G., & SONS, LTD.
Porcelain Bath with Broad and Anti-splash Rim.
HOWSON, G., & SONS, LTD.
Range of Two (number 34) Urinals.
KIRTLEY & SON, LTD.
Mowbray Tipping Ashbin.
KIRTLEY & SON, LTD.
Mowbray Earth Closet Hatch.
ROWE BROS. & CO., LTD.
Lead Pipes.
SLINGSBY, H. C.
Sliding-wheel Trollies and Trucks.
SLINGSBY, H. C.
Extension Ladder.
STANDARD RANGE AND FOUNDRY CO., LTD.
Combination Heating and Cooking Range.
STANDARD RANGE AND FOUNDRY CO., LTD.
The "Burkone" Fire.
W. SUMMERSCALES & SON, LTD.
Steam-jacketed Cooking Pan.
TAROADS SYNDICATE, LTD.
Tar Spraying Machine.
THOMPSON, HENRY.
Set-pot Steam Destroyer.
THE SANITARY PUBLISHING CO., LTD.
Standard Books on Sanitary Science.
THE UNDERWRITERS' FIRE APPLIANCES, LTD.
The "Accurate" Fire Extinguisher.
WILLIAMS, T. G., & CO.
Mack Slabs for Partitions and Roofs.

DEFERRED FOR FURTHER CONSIDERATION.

ADAMS-HYDRAULICS, LTD.
Conical Manhole and Lamphole Covers.
BIRCH, KILLON, & CO.
Fiddian Travelling Sewage Distributors.
BURN BROS.
Alternating and Timing Siphons for Sewage Disposal.
CANDY FILTER CO., THE.
Compressed Air Waterworks Filter.
DEFRIES, J., & SONS, LTD.
"The Meridionizer."

GLENFIELD & KENNEDY, LTD.
Lea's Patent Water-consumption Recorder.
HEENAN & FROUDE.
Refuse Destructor.
JEYES SANITARY COMPOUNDS CO., LTD.
Cyllin.
JEYES SANITARY COMPOUNDS CO., LTD.
Cyllin (Medical).
KENT, GEORGE, LTD.
Hodgson's Sewage Disposal Works Fittings.
MCDOUGALL BROS.
Disinfecting Fluid.
QUIBELL BROS., LTD.
Kerol.
QUIBELL BROS., LTD.
Kerol (Medical).
SANITARY FLOOR COMPANY, THE.
Dustolio.

EXAMINATIONS.

The following Examinations have been held:—

Sanitary Science as applied to Buildings and Public Works.

Birmingham, July 3rd and 4th. 10 Candidates: 4 Certificates granted.

Hygiene in its Bearing on School Life.

Birmingham, July 3rd and 4th. 16 Candidates: 12 Certificates granted.

Women Health Visitors and School Nurses.

Birmingham, July 3rd and 4th. 5 Candidates: 1 Certificates granted.

Inspectors of Nuisances.

Birmingham, July 3rd and 4th. 58 Candidates: 23 Certificates granted.

Inspectors of Meat and other Foods.

Leeds, July 24th and 25th. 21 Candidates: 9 Certificates granted.

CANDIDATES WHO HAVE RECEIVED CERTIFICATES.

Sanitary Science as applied to Buildings and Public Works.

BARRATT, RALPH WILLIAM.
HARRIS, CHARLES EDWIN.
PRITCHARD, GEORGE HERBERT.
SMITH, ANNIE BURNS.

Hygiene in its Bearing on School Life.

ADAMS, HENRY JAMES.
BOON, REGINALD PERCY.
DEARDEN, ALICIA.
DUNBAR, JOSEPHINE INGLIS.
GRIEVE, MARGARET BRUCE.
LYDDON, ANNIE LOUISA.
MARRIOTT, ELSIE MALLA.
RYELL, ESTHER.
TURLEY, EDGAR.
TUSTAIN, ANNIE AGNES.
WEDD, WILLIAM FREDERICK.
WILSON, LUCY MARY.

Women Health Visitors and School Nurses.

BRIDGE, BESSIE COLERIDGE.
BROCKLEBANK, OLIVE.
BULLOUGH, GERTRUDE.
ELMHIRST, ROSA.

Inspectors of Nuisances.

ATKINSON, SIDNEY FRANK.
BOYLIN, FRANK.
BREFFIT, WILLIAM.
BROCK, ERNEST ROBERT.
DAVIES, THOMAS.
DAWSON, HARRY.
ELLIS, FREDERIC HENRY.
FLINT, GERALD GEORGE.
GODDARD, LLEWELLYN BEAUMONT.
GOODE, WILFRID JOSEPH.
HARDY, WILLIAM GATHORNE.
HART, THOMAS.
HOBSON, HARRY.
JONES, ALFRED.
KERSHAW, LAWRENCE WILLIAM.
LANE, ALBERT HENRY.
LOACH, ALFRED EDWIN.
MACARTHUR, ROBERT TAYLOR.
NEWBOUND, ALBERT EVERARD.
PRICE, FREDERICK GEORGE.
ROBINSON, ALEXANDER LLEWELLYN.
TENNANT, HENRY.
WELBURN, THOMAS GORDON.

Inspectors of Meat and other Foods.

ACKERNLEY, JOSEPH.
BARKER, WILLIAM JOHN.
HERMANN, JOSEPH.
MCINTYRE, PETER, M.R.C.V.S.
MITCHELL, HERBERT.
MOORHOUSE, ERNEST FREDERICK.
PEARCE, WILLIAM.
RIDSDALE, ERNEST.
SPENCER, JULIUS.

FORTHCOMING MEETINGS.

SESSIONAL MEETING.

London, September 26th. Arrangements are being made for a one day's Conference to be held at the Franco-British Exhibition, on Saturday, September 26th. The Council have invited the Société Française d'Hygiène to co-operate in the meeting.

The Programme for the meeting will be:

Morning sitting—
Discussion on "The Purification of Water by Electrical or Chemical methods."
Luncheon in the Exhibition.

Afternoon meeting—
Discussion on "Road Surfaces in Relation to Motoring, and the Regulation of the Motor Traffic."

Evening—
Dinner in the Exhibition.

EXAMINATIONS.

Inspectors of Meat and Other Foods—
Cardiff, October 2nd and 3rd.

In Sanitary Science as applied to Buildings and Public Works, for

Inspectors Qualifying for Membership, for Inspectors of Nuisances, in Hygiene in its Bearing on School Life, and for Women Health Visitors and School Nurses—

Nottingham, October 9th and 10th.

STUDENTS' LECTURES.

Sanitary Officers.

The Forty-sixth Course of Lectures and Demonstrations to Sanitary Officers will commence on Wednesday, September 23rd. The Lectures are arranged to include the subjects scheduled for the Examination for Inspectors of Nuisances held by The Royal Sanitary Institute and the Sanitary Inspectors' Examination Board (formed by The Sanitary Institute and other bodies).

Sanitary Science as applied to Buildings and Public Works.

A Course of Lectures and Practical Demonstrations has been arranged to assist those desiring instruction in Sanitary Science as applied to Buildings and Public Works, suitable to Foremen of Works, Builders, and those engaged in Allied Trades, Managers of Properties, Teachers, and Lecturers, and others who are desirous of obtaining the Certificate of the Institute in Sanitary Science as applied to Buildings and Public Works.

The Course will commence on Saturday, September 26th.

Hygiene in its Bearing on School Life.

This Course of Lectures has been arranged to assist Teachers and others interested in the training of children and the structural conditions of the School, who purpose entering for the Examination of the Institute in Hygiene in its Bearing on School Life.

The Course will commence on Monday, October 5th.

Practical Training for Meat Inspectors,

for candidates preparing for the Examination for Inspectors of Meat and Other Foods, conducted by The Royal Sanitary Institute.

The Thirteenth Course will commence on Thursday, October 1st, and will consist of systematic Practical Training in the Inspection of Meat at a Cattle Market, including Demonstration on live cattle and sheep, slaughtering and dressing of animals, names and situations of the organs, diseases of animals, methods of stalling, arrangements of markets and byres, etc., and will include the Lectures on Meat and Food Inspection given in the Parkes Museum, Demonstration and Inspection on Fish, and Inspection and Demonstration at a Knacker Yard.

Special Course on Food and Meat Inspection.

Eighth Special Course of Practical Training in Food and Meat Inspection for Commissioned Officers and Professional Students preparing for the Examination for Inspectors of Meat and Other Foods, conducted by The Royal Sanitary Institute, will commence on Monday, Nov. 9th.

The dates and subjects of the Lectures and Demonstrations in each Course are given month by month in the Calendar.

Calendar for September and October, 1908.

As far as at present arranged.

SEPTEMBER.

23 W. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, A: Introductory Remarks, Public Health Acts—English, Scotch, Irish; other Statutes relating to Public Health; By-laws (Model, etc.), Regulations, Orders, Memoranda, etc., by J. Priestley, B.A., M.D., M.R.C.S., D.P.H., M.O.H. Lambeth.

25 F. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, B: Public Health (London) Act; Metropolis Local Management Acts; By-laws and Regulations in force in the Administrative County of London, by J. Priestley, B.A., M.D., M.R.C.S., D.P.H.

26 S. Conference at Franco-British Exhibition. Discussions: 11 a.m., on "The Purification of Water by Electrical or Chemical Methods"; 2 p.m., on "Road Surfaces in Relation to Motoring and the Regulation of the Motor Traffic."

26 S. Inspection and Demonstration at Wimbledon Sewage Works, at 2.45 p.m. Conducted by C. H. Cooper, M.Inst.C.E., Borough Engineer and Surveyor.

28 M. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, C: Factory and Workshop Acts (including Bakehouse Legislation, 1878–95) as they affect the Sanitary Inspector; Smoke Legislation; Food and Drugs Acts, 1899, by J. Priestley, B.A., M.D., M.R.C.S., D.P.H.

30 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

30 W. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—General, A: Outdoor, by A. Wellesley Harris, M.R.C.S., D.P.H., M.O.H., Lewisham.

OCTOBER.

1 Th. Lecture—Meat Inspectors' Course at 6.30 p.m.

1 Th. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—General, B: Indoor, by A. Wellesley Harris, M.R.C.S., D.P.H.

2 F. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—C: Offensive Trades and Trade Nuisances, etc., by A. Wellesley Harris, M.R.C.S., D.P.H.

2 F. }
3 S. } Examination for Inspectors of Meat and other Foods, Cardiff.

3 S. Inspection and Demonstration at the Southwark and Vauxhall Water Works, Hampton, at 2.30 p.m. Conducted by J. W. Restler, M.Inst.C.E.

5 M. Lecture to Sanitary Officers at 7 p.m. "Infectious Diseases," by Prof. A. Bostock Hill, M.D., M.SC., M.O.H. Warwickshire C.C.

6 T. Lecture to Sanitary Officers at 7 p.m. "Methods of Disinfection," by Prof. A. Bostock Hill, M.D., M.SC.

7 W. Inspection and Demonstration at John Knight & Son's Soap Works, Silvertown, at 3 p.m.

7 W. Lecture to Sanitary Officers at 7 p.m. "Elementary Statistics," by Prof. A. Bostock Hill, M.D., M.SC.

8 Th. Lecture to School Teachers, at 7 p.m. "Physiology," by Prof. H. R. Kenwood, M.B., D.P.H.

8 Th. Demonstration of Book-keeping as carried out in a Sanitary Inspector's Office, at the Public Health Office, Town Hall, Upper Street, Islington, N., at 7 p.m., by James R. Leggatt, Supt., Public Health Department, Borough of Islington.

9 F. Lecture—Meat Inspectors' Course, at 6.30 p.m.

9 F. Lecture to Sanitary Officers at 7 p.m. "Elementary Science: Physics, Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

9 F. }
1 S. } Examinations—Nottingham.

10 S. Inspection and Demonstration at the Lambeth Disinfecting Station, at 2.30 p.m. Conducted by J. Priestley, M.D., D.P.H., M.O.H. Lambeth.

LIST OF MEMBERS AND ASSOCIATES ELECTED,
JULY, 1908.

MEMBERS.

" Marked thus have passed the Examination in Sanitary Science as applied to Buildings and Public Works.

‡ Marked thus have passed the Examination for Inspectors of Nuisances.

* Marked thus have passed the Examination Qualifying for Membership.

Reg. No.	Date of Election.	
2[1]	1908. July.	AULT, Edwin, F.S.I., M.INST.MECH.E., 47, *Victoria Street, Westminster, S.W.*
2[2]	1908. July.	*BAILEY, Thomas Richmond, 20, *Kemp Street, Fleetwood.*
2[3]	1908. July.	COLWELL, James Kear, F.I.C., *Public Analyst's Laboratory, Town Hall, Rosebery Avenue, E.C.*
2[4]	1908. July.	GLASSE, John Morley, M.B., CH.B.EDIN., (*M.O.H.*), *Eden House, Haltwhistle, Northumberland.*
2[5]	1908. July.	HOGARTH, Archibald Henry, M.B., B.CH., D.P.H., (*M.O.H.*), *Toynbee Hall, Whitechapel, E.*
2[6]	1908. July.	*HOOPER, Harold Thomas, P.A.S.I., 16, *Osborne Road, Thornton Heath, Surrey.*
2[7]	1908. July.	HUMPHREYS, Charles Evan, M.R.C.S., L.S.A.LOND., (*M.O.H.*), *Mountcoinion, Llanfair-Caereinion, Montgomery.*
2[8]	1908. July.	*JONES, John Griffith, 31, *Acris Street, East Hill, Wandsworth, S.W.*
2[9]	1908. July.	JONES, William Matthews, F.I.S.E., F.C.S., F.R.MET. SOC., *City Surveyor, Town Hall, Chester.*
2[10]	1908. July.	‡MARSHALL, William Gray, *Grays, Essex.*
2[11]	1908. July.	PICKLES, Frank A., ASSOC.M.INST.C.E., 11, *Park Row, Nottingham.*
2[12]	1908. July.	‡PURNELL, Arthur Edward, 112, *Northcote Road, Wandsworth Common, S.W.*
2[13]	1908. July.	SCOTT, Thomas Henderson, MEM.I.A.M. & C.E., *Burgh Engineer, Town House, Inverness.*
2[14]	1908. July.	"SHARP, Harold Gibbon, "*Lyndene*," *Greenacre Street, Oldham.*

ASSOCIATES.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.

M Marked thus have passed the Examination of the Institute for Inspectors of Meat and Other Foods.

S Marked thus have passed the Examination of the Institute on Hygiene in its bearing on School Life.

Reg. No.	Date of Election.	
4[85]	1908. July.	‡ARMITAGE, Frank, 17, *West Lea Avenue, Harrogate.*
4[86]	1908. July.	‡BAGOT, H. R., 39, *Park Street, Greenwich, S.E.*
4[87]	1908. July.	‡BATEMAN, Arthur, 1, *Cleveland Terrace, Redcar, Yorks.*
4[88]	1908. July.	‡FARNELL, William Robert, 11, *Randolph Street, Moston, Manchester.*

1908. July. ‡Fletcher, Thomas Drinkwater. *Whitehough Lane, Chinley, near Stockport.*
1908. July. s Griffith, Miss Dora. 40, *Carill Drive, Fallowfield, Manchester.*
1908. July. ‡Holden, William Arthur, 178, *Great Clowes Street, Manchester.*
1908. July. m Jerrom, John Henley G., 49, *David Place, St. Heliers, Jersey.*
1904. Oct. ‡Jones, T. Owen. *Sanitary Inspector, Wrexham.*
1908. July. ‡Lord, Miss Bessie, 100, *Campo Lane, Sheffield.*
1908. July. ‡Parnell, Harry, 51, *Beachcroft Avenue, Southall.*
1908. July. ‡Pascoe, Miss Rose Wells, 30, *Wayland Road, Sheffield.*
1908. July. ‡Price, John Rowland, *Sandbach, Cheshire.*
1908. July. ‡Richardson, Miss Maud Augusta, 110, *Burgess Street, Grimsby.*
1908. July. ‡Robertson, Miss Kathleen McLean, 49, *North Castle Street, Edinburgh.*
1908. July. ‡Selby, James W., 129, *Eldon Street, Oldham.*
1908. July. ‡Sumner, Henry, *White Croft, Mellor, near Blackburn.*
1908. July. ‡Thomas, Joshua, *Llwynhendy, Llanelly, Carmarthen.*
1908. July. ‡Thomson, Alex. L., *Oldschool, Burnhaven, Peterhead, N.B.*
1904. May. ‡Walker, Francis James Beecher, *Inspector of Nuisances, Bingham R.D.C., Notts.*
1908. July. m Watt, William Alexander, *Crown Mansions*, 41½, *Union Street, Aberdeen.*
1908. July. ‡Winterbottom, Arthur, 8, *Belgrave Road, New Moston, Manchester.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY*

* *For Publications of Societies and Institutions, etc., see under "Academies."*

Academies (American).

Philadelphia. Transactions of the College of Physicians of Philadelphia. 138 pp., 8vo. Philadelphia, 1907. *The College.*

Washington. Report of the Commissioner of Education for the Year ending June 30th, 1906. 8vo. Washington, 1908. *The Commissioner.*

Academies (British).

London. *The Surveyors' Institution.* Transactions, Session 1907–1908, Vol. XL., Part X. Transactions, Session 1907–1908, Vol. XL., Part XI. *The Institution.*

——— *The Royal Statistical Society.* Journal, Vol. LXXI., Part I., 1908. 289 pp., 8vo. London, 1908. *The Society.*

* Members or Associates wishing to file or catalogue these Titles can, on application, be supplied with excerpt copies for this purpose.

London. *Society of Civil and Mechanical Engineers.* Transactions, 49th Session, 1907-1908. 140 pp., 8vo. London, 1908. *The Society.*

——— *Society of Engineers.* Transactions, 1907, and General Index, 1857–1907. 294 pp., 8vo. London, 1908. *The Society.*

Allen, *Greta.* Practical Hints to Health Visitors. 86 pp., 8vo. London 1908. *The Scientific Press, Ltd.*

Bashore, *Dr. Harvey B.* The Sanitation of Recreation Camps and Parks. 109 pp., 8vo. London and New York, 1908. *The Author.*

Berne. Mariages, Naissances et Décès. 83 pp., 4to. Berne, 1908. *Bureau de Statistique.*

Beveridge, *Major W. W. O., D.S.O., R.A.M.C., and* **Fawcus.** *Capt. H. B., R.A.M.C.*

Beverley. Report on an Investigation as to the Contamination of Milk. 113 pp., fcp. *John Bickersteth.*

Bruxelles. Rapport Annuel, 4e Division Administrative. 118 pp., 8vo. Bruxelles, 1907. *Le Collège des Bourgmestre et Echevins.*

Calmette, *Dr. A., and* **Rolants,** *Par E.* Recherches sur l'Epuration Biologique et Chimique des Eaux d'Egout. 121 pp., 4to. Paris, 1908. *The Authors.*

Ehrlick, *Prof. Paul.* Experimental Researches on Specific Therapeutics. 95 pp., 8vo. London, 1908. *H. K. Lewis (publisher).*

Factories and Workshops. Annual Report of the Chief Inspector of Factories and Workshops for the year 1907. 321 pp., fcp. London, 1908. *The Chief Inspector.*

Garden City Association. Housing in Town and Country. 80 pp., 8vo. London, 1906. *W. Whitaker, B.A., F.R.S.*

Gusztav, *Dr. Thirring.* Budapest Székesováros Statisztikai Evkonyve. 359 pp., 4to. Budapest, 1907. *The Author.*

Harris, *G. Montagu.* The Garden City Movement. 92 pp., 8vo. London, 1906. *W. Whitaker, B.A., F.R.S.*

Horsfall, *T. C.* The Relation of Town Planning to the National Life. 17 pp. *The Author.*

Jensen, *G. J. C.* Cast-iron House Drainage: with special reference to the drainage of town houses. 206 pp., 8vo. London. 1908. *The Sanitary Publishing Co., Ltd. (publishers).*

Kenwood, *Prof. H. R., M.B., D.P.H.* Public Health Laboratory Work. Fourth Edition. 468 pp., 8vo. London, 1908. *H. K. Lewis (publisher).*

Khlopine, *Prof. G.* Le controle sanitaire des livres d'études et des manuels en Russie. 3 pp., 8vo. Leipzig, 1907.

Lister Institute of Preventive Medicine. Collected Papers. No. 4. *The Institution.*

Local Government Board. Report by Dr. F. St. George Mivart on the General Sanitary Circumstances and Administration of the Hollingbourn Rural District. 10 pp., fcp. London, 1908.

Report by Dr. S. Monckton Copeman to the Local Government Board on the General Sanitary Circumstances and Administration of the Brixworth Rural District, Northamptonshire. 13 pp., fcp. London, 1908.

Report by Dr. A. W. J. Macfadden on Preservatives in Canned and Glass-packed Meats of Home and Foreign Origins, with Observations on the Manufacture of such Meat. 37 pp., fcp. London, 1908.
Arthur Newsholme, M.D., F.R.C.P., D.P.H.

London. How to become a Lady Sanitary Inspector, by a Lady Inspector. 30 pp., 8vo. London, 1908. *The Scientific Press, Ltd.*

——— Report of the Proceedings of the National Conference on Infantile Mortality. 200 pp., 8vo. London, 1908. *Messrs. P. S. King & Son (publishers).*

——— Catalogue of Lewis's Medical and Scientific Circulating Library. 500 pp., 8vo. London, 1908. *H. K. Lewis.*

Macfadyen, *Allan, M.D., B.Sc.* Some collected Papers of the late Allan Macfadyen.

MacMurchy, *Dr. Helen.* Feeble-minded in Ontario. 31 pp., 8vo. Toronto, 1908. *The Author.*

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Aberdeen (Sanitary Inspectors), 1907 *Kenneth Cameron.*
Aberdeen, May, 1908 .. .. *Matthew Hay, M.D.*
Batley (Inspector of Nuisances), 1907 *J. Lindley, A.R.San.I.*
Bethnal Green, 1907 .. .. *George Paddock Bate, M.D.*
Bexhill, 1907 .. .. *Oswald Osborne, M.D.*
Birkenhead, 1907 .. .. .. *R. Sidney Marsden, M.D.*
Blackburn (Education Committee), 1907 .. .. *Alfred Greenwood, M.D., D.P.H.*
Blackburn, 1907 .. .. .. *Alfred Greenwood, M.D., D.P.H.*
Bridlington R.D.C., 1907 .. .. *William A. Wetwan, M.R.C.S.*
Bristol, Port Sanitary District, 1907. *D. S. Davies, M.D., D.P.H.*
Cardiff, Port Sanitary Authority, 1907 *E. Walford, M.D., D.P.H.*
Carnarvonshire, 1907 .. .. *P. Fraser, M.D., B.Sc.*
Chiswick U.D.C., 1907 .. .. *J. H. Clarke, M.R.San.I.*
Cleethorpes-with-Thrunscoe, 1907 .. *Edward W. Turner, A.R.San.I.*
Cornwall, April, May, June, 1908 .. *John R. de C. Boscawen.*
Coventry, 1907 .. .. .. *E. H. Snell, M.D., B.Sc.Lond.*
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Derby, 1907 .. .. *William J. Howarth, M.D., D.P.H.*
Liverpool, 1907 .. .. .. *E. W. Hope, M.D., D.Sc.*
Darwen, 1907 .. .. .. *F. G. Haworth, M.B., C.M.*
Durham C.C., 1906 .. .. .. *T. Eustace Hill, M.B., B.Sc., F.I.C.*
Edinburgh, Sanitary and Markets Department, 1907 .. .. *A. Maxwell Williamson, M.D., B.Sc.*
Edinburgh (City Engineer), 1907 .. *James Massie.*
Exeter, 1907 .. .. *Edward A. Brash, L.R.C.P.*
Failsworth U.D.C., 1907 .. .. *G. Sharp Leslie, M.B.*
Glossop-Dale R.D.C., 1907, and Special Report on Death-rate, 1906 *D. J. Mackenzie, M.D.*
Glossop U.D.C., 1907 .. .. *D. J. Mackenzie, M.D.*
Gloucestershire, Nineteenth Annual Report of the Highways and General Purposes Committee .. *E. S. Sinnott, M.Inst.C.E.*
Godstone R.D.C., Surveyor's Report, 1907 (Building and Sanitary Surveyor), 1907 .. .. .. *Thos. Barralet, M.R.San.I.*
Greenwich, 1907 .. .. .. *E. G. Annis, M.R.C.S., L.R.C.P., D.P.H.*

Hampstead, 1907	*G. F. McCleary, B.A., M.D., D.P.H.*
Harrow-on-the-Hill U.D.C., 1907	*J. Fletcher Little, M.B., M.R.C.P.*
Hereford, 1907	*H. Cecil Moore, M.R.C.S., L.S.A.*
Huddersfield Education Committee (Medical Officer for Schools), 1907	*G. W. Kilner Crosland.*
Huddersfield, January–March, 1908	*S. G. Moore, M.D., D.P.H.*
Ipswich, 1907	*A. M. N. Pringle, M.D., D.P.H.*
Johannesburg, Town Engineer's Report for 1907	*G. S. Burt Andrews, M.Inst.C.E.*
Kensington, 1907	*T. Orme Dudfield, M.D.*
King's Norton & Northfield U.D.C., 1907	*R. Green, M.D., D.Hy., D.P.H.*
Lincoln, Urban Sanitary Authority,	
Liverpool, 1907	*E. W. Hope, M.D., D.Sc.*
London (City of), 1907	*W. Collingridge, M.D., D.P.H.*
London (Port of), 1907	*Herbert Williams, M.D., D.P.H.*
London, March, April, 1908	*W. Collingridge, M.D., D.P.H.*
Longton, 1907	*J. W. Dawes, M.B., C.M.*
Maidstone, 1907	*W. Jackling, A.R.San.I.*
Mersey and Irwell Joint Committee	*Hugh Stowell, Assoc.M.Inst.C.E.*
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Middlesborough, 1907	*G. Anderson, A.R.San.I.*
Newcastle-upon-Tyne, 1907	*Henry E. Armstrong, D.Hy.*
Newport, Port Sanitary Authority, 1907	*J. Howard-Jones, M.D., D.Sc.*
New Windsor, 1907	*E. Casey, M.D., B.S., M.B.*
Northamptonshire, 1907	*Dr. C. E. Paget.*
Paddington, Metropolitan Borough, 1907	*Reginald Dudfield, M.A., M.B., D.P.H.*
Paignton U.D.C., 1907	*J. Crathorn, A.R.San.I., Sanitary Inspector.*
Penge, 1907	*Henry J. Prangley, M.R.C.S., L.R.C.P.*
Port Elizabeth, South Africa, 1907	*S. Henry Kemp, Assoc.R.San.I.*
Queensland, 1907	*B. Burnett Ham, M.D., D.P.H.*
Richmond, 1907	*J. H. Crocker, M.D., D.P.H.*
Rothwell U.D.C., 1907	*R. Stevenson, L.R.C.P., L.R.C.S.*
Scarborough, 1907	*John Knight, M.D., D.P.H.*
Southport, 1907	*J. J. Weaver, M.R.C.S., L.S.A.*
Stockport, 1907	*Meredith Young, M.D., D.P.H.*
St. Helen's, 1907	*John J. Buchan, M.D., D.P.H.*
St. Marylebone, 1907	*Meredith Young, M.D., D.P.H.*
Surbiton, 1907	*O. Coleman, M.D., D.P.H.*
Tunbridge Wells, 1907	*W. Stamford, L.R.C.P.*
Tyne Port, 1907	*W. E. Harker, M.D., D.Hy.*
Warwick, 1908	*Prof. A. Bostock Hill, M.D., M.Sc.*
Waterloo-with-Seaforth U.D.C., 1907	*W. S. Limrick, L.R.C.P., L.R.C.S.*
Wednesbury, for Year ended Dec. 31st, 1907	*W. C. Garman, M.D.*
West Bromwich, 1907	*H. Manley, M.A., M.D., D.P.H.*
Wimbledon, 1907	*E. Pocklington, M.R.C.S., L.S.A.*
Woking, San. Inspector's Rept., 1907	*J. H. Ablett, M.R.San.I.*
Woolwich, 1907	*Sidney Davies, M.A., M.D., D.P.H.*
Yeovil, 1907	*H. Page, M.D., D.P.H.*

THE ROYAL SANITARY INSTITUTE.

REVIEWS OF BOOKS.

The Ritual of Temperance and Bodily Cleanliness.*

This little book contains useful information for the general public concerning the use and abuse of alcohol, tea, coffee, cocoa, and water as beverages, and the cleansing of the skin by means of hot-air baths; but the author's choice of words is not always to be commended, and many of his sentences convey the impression that he is straining after effect, a practice necessarily to be deprecated on the part of one engaged in conveying scientific facts to the popular mind.

The following passage, however, gives some salient facts about alcohol as an article of diet, in language but little open to criticism:—

"Let us hear the conclusion of the whole matter. Alcohol in any form is not a necessary article of diet to the healthy. It is a food in the scientific sense, in that in its oxidation it yields heat and energy. It is, however, of very limited practical value as a food, and is very costly. The most it can do is to replace a small amount of fat, and possibly of carbo-hydrate, in the human dietetic laboratory. As a food it is about ten times dearer than bread, for example, and one has to remember that its effects upon the nervous and circulatory systems counteract the benefit which might otherwise result from the production by it of heat and energy. Alcohol as a food is not favourable to the production of sustained muscular exertion, and may do positive harm by paralysing temporarily the sense of fatigue, which is Nature's warning against excessive effort."

There are few passages of equal length, unfortunately, which are not disfigured by technical terms out of place in a popular work, or by some such stilted or awkward words and expressions as the following: "It may be taken *hotted choicely*"; "viands *engulfed* at luncheon"; "an effective *racial agent*"; "*argal*, (for ergo?) the gouty and rheumatic"; and "the *baccilicidic* action of."

But the lay reader who is not sensitive to defects of this character, and can understand the fantastic and technical words and phrases, will find the book readable and instructive. P. B.

FORTHCOMING MEETINGS.

Sessional Meetings.

York, October 17th, 11 a.m. Discussion on "The Architecture and Sanitation of Elementary School Buildings." Visits to Council Schools and the Waterworks, where the Jewell System of Filtration is to be seen.

Durham, November 14th. Discussion on "The Health Visitor and the School Nurse in relation to Sanitary Administration," to be opened by H. Renney, M.D., D.P.H., Medical Officer of Health, Sunderland. Visits will be made to the Cathedral and Castle, and to Finchale Abbey.

*The Ritual of Temperance and Bodily Cleanliness. By H. Cooper Pattin, M.A., M.D., D.P.H. Price 1s. Simpkin, Marshall, and Co., London.

Examinations.

Inspectors of Meat and Other Foods—
Cardiff, October 2nd and 3rd.
Birmingham, October 23rd and 24th.

In Sanitary Science as applied to Buildings and Public Works, for Inspectors Qualifying for Membership, for Inspectors of Nuisances, in Hygiene in its Bearing on School Life, and for Women Health Visitors and School Nurses—
Nottingham, October 9th and 10th.
Perth, October 16th and 17th.
Liverpool, October 30th and 31st.

Calendar for September and October, 1908.

As far as at present arranged.

SEPTEMBER.

23 W. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, A: Introductory Remarks, Public Health Acts—English, Scotch, Irish; other Statutes relating to Public Health; By-laws (Model, etc.), Regulations, Orders, Memoranda, etc., by J. Priestley, B.A., M.D., M.R.C.S., D.P.H., M.O.H. Lambeth.

25 F. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, B: Public Health (London) Act; Metropolis Local Management Acts; By-laws and Regulations in force in the Administrative County of London, by J. Priestley, B.A., M.D., M.R.C.S., D.P.H.

26 S. Inspection and Demonstration at Wimbledon Sewage Works, at 2.45 p.m. Conducted by C. H. Cooper, M.Inst.C.E., Borough Engineer and Surveyor.

28 M. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, C: Factory and Workshop Acts (including Bakehouse Legislation, 1878-95) as they affect the Sanitary Inspector; Smoke Legislation; Food and Drugs Acts, 1899, by J. Priestley, B.A., M.D., M.R.C.S., D.P.H.

30 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

30 W. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector General, A: Outdoor, by A. Wellesley Harris, M.R.C.S., D.P.H., M.O.H., Lewisham.

OCTOBER.

1 Th. Lecture—Meat Inspectors' Course at 6.30 p.m.

1 Th. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector General, B: Indoor, by A. Wellesley Harris, M.R.C.S., D.P.H.

2 F. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—C: Offensive Trades and Trade Nuisances, etc., by A. Wellesley Harris, M.R.C.S., D.P.H.

2 F.
3 S. } Examination for Inspectors of Meat and other Foods, Cardiff.

3 S. Inspection and Demonstration at the Southwark and Vauxhall Water Works, Hampton, at 2.30 p.m. Conducted by J. W. Restler, M.Inst.C.E.

5 M. Lecture to Sanitary Officers at 7 p.m. "Infectious Diseases," by Prof. A. Bostock Hill, M.D., M.Sc., M.O.H. Warwickshire C.C.

6 T. Lecture to Sanitary Officers at 7 p.m. "Methods of Disinfection," by Prof. A. Bostock Hill, M.D., M.Sc.

7 W. Inspection and Demonstration at John Knight & Son's Soap Works, Silvertown, at 3 p.m.

7 W. Lecture to Sanitary Officers at 7 p.m. "Elementary Statistics," by Prof. A. Bostock Hill, M.D., M.SC.

8 Th. Lecture to School Teachers, at 7 p.m. "Physiology," by Prof. H. R. Kenwood, M.B., D.P.H.

8 Th. Demonstration of Book-keeping as carried out in a Sanitary Inspector's Office, at the Public Health Office, Town Hall, Upper Street, Islington, N., at 7 p.m., by James R. Leggatt, Supt., Public Health Department, Borough of Islington.

9 F. Lecture—Meat Inspectors' Course, at 6.30 p.m.

9 F. Lecture to Sanitary Officers at 7 p.m. "Elementary Science: Physics, Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

9 F. } Examinations—Nottingham.
10 S. }

10 S. Inspection and Demonstration at the Lambeth Disinfecting Station, at 2.30 p.m. Conducted by J. Priestley, M.D., D.P.H., M.O.H. Lambeth.

12 M. Demonstration on Meteorological Instruments in the Parkes Museum, at 6 p.m., by the Director, E. White Wallis, F.S.S.

12 M. Lecture to School Teachers at 7 p.m. "Physiology," by Prof. H. R. Kenwood, M.B., D.P.H.

12 M. Lecture to Sanitary Officers at 7 p.m. "Elementary Science. Physics, Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

13 Tu. Lecture to Sanitary Officers at 7 p.m. "Elementary Science: Physics, Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

14 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt. Public Health Department, Borough of Islington.

14 W. Lecture to Sanitary Officers at 7 p.m. "Elementary Science: Physics, Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

14 W. Lecture to School Teachers, at 7 p.m. "Foods," by Col. J. Lane Notter, R.A.M.C., M.A., M.D., D.P.H.

17 S. **Sessional Meeting,** YORK, 11 a.m. Discussion on "The Architecture and Sanitation of Elementary School Buildings." Visits to the Council Schools and the Waterworks.

NOVEMBER.

14 S. **Sessional Meeting,** DURHAM. Discussion on "The Health Visitor and the School Nurse in relation to Sanitary Administration," to be opened by H. Renney, M.D., D.P.H., M.O.H. Sunderland. Visits will be made to the Cathedral and Castle, and to Finchale Abbey.

CONTRIBUTIONS AND ADDITIONS TO LIBRARY

DURING AUGUST, 1908.

*** *For Publications of Societies and Institutions, etc., see under* "*Academies.*"

ACADEMIES (BRITISH).

London. *The Institution of Civil Engineers.* Minutes and Proceedings, Vol. CLXXI. 552 pp., 8vo. London, 1908. *The Institution.*

New South Wales. *Royal Society of.* Journals & Proceedings, Vols. XXXVII., XXXVIII., XXXIX., XL., XLI. *The Society.*

Allen, *Greta.* Practical Hints to Health Visitors. 86 pp., 8vo. London, 1908. *The Author.*

Elkington, *J. S. C., M.D.* Handbook and Model Laws. 83 pp., 8vo. Tasmania, 1905. *The Author.*

Grimshaw, *J., M.D., M.S.* Your Child's Health. 144 pp., 8vo. London, 1908. *Messrs. J. & A. Churchill (publishers).*

Jensen, *G. J. C., C.E.* By-Laws as to House Drainage and Sanitary Fittings made by the London County Council. Second Edition. 147 pp., 8vo. London, 1908. *The Sanitary Publishing Co.*

Local Government Board. Dr. W. W. E. Fletcher's report to the Local Government Board upon the Sanitary Circumstances and Administration of the St. Asaph (Flintshire) and of the St. Asaph (Denbighshire) Rural Districts. 17 pp., fcp. London, 1908. *A. Newsholme, M.D., F.R.C.P., D.P.H.*

Martin, *A. J., M.Inst.C.E.* Report on the Sewerage of Geelong, Newtown, and Chilwell, North Geelong, and Belmont. 40 pp., 4to. Geelong, 1908. *The Author.*

MEDICAL OFFICERS OF HEALTH AND OTHER SANITARY REPORTS.

Aberdeen, July, 1908	*Kenneth Cameron.*
Birmingham, 1907	*J. Robertson, M.D., B.Sc.*
Blackpool, 1907	*Francis J. H. Coutts, M.D., D.P.H.*
Bristol, 1907	*D. S. Davies, M.D., D.P.H.*
Cardiff, 1907	*E. Walford, M.D., D.P.H.*
Chester, 1907	*Francis Vacher, M.R.C.S.*
Cornwall, July, 1908	*John R. de C. Boscawen.*
Huddersfield, 1907	*S. G. H. Moore, M.D., D.P.H.*
Northampton, 1907	*James Beatty, M.A., M.D., and J. Doig McCrindle, M.B., D.P.H.*
Oldham, 1907	*J. B. Wilkinson, M.B., D.P.H.*
Poplar, 1907	*F. W. Alexander, M.D.*
Preston, 1907	*H. O. Pilkington, M.D.*
Salford, 1907	*C. H. Tattersall, M.R.C.S.*
Surrey C.C., 1907	*Edward S. Seaton, M.D., F.R.C.P.*
York, 1907	*E. M. Smith, M.D., D.P.H.*

COLONIAL NOTE.

Board of Examiners for South Australia.

Additional Examiner:—J. F. McEachran, M.R.C.V.S., Graduate of Glasgow Veterinary College; Inspector of Cattle and Analyst, Combined Metropolitan Boards of Health, Adelaide.

Hong Kong and South China.

His Excellency Sir F. D. Lugard, G.C.M.G., C.B., D.S.O., has graciously consented to become the Patron of the Hong Kong Branch of The Royal Sanitary Institute.

THE ROYAL SANITARY INSTITUTE.

REVIEWS OF BOOKS.

Elements of Water Bacteriology.*

A little book has an advantage over a big book in the handiness of its application, and is often consulted when larger ones are left literally on the shelf, such tomes for instance as Woodman & Tidy's excellent but sparsely-found treatise which they unhappily called "A Handy-book of Forensic Medicine." Prescott & Winslow by judicious compression—brevity without sacrifice of style or clearness—have in their second edition retained the convenient text-book value of the first issue, at the same time including subsequent international work, giving full credit to the observers, and furnishing references to papers in an appendix. The "coli" question is discussed at length, and it is pleasant to note the remark (p. 123) that "the most important work upon the distribution of B. coli has been carried out in England by the bacteriologists of the Local Government Board." A caution showing that chemical analysis and other examinations should not be neglected is (p. 138) that "a low monthly average of coli may include and cover up dangerous and significant high numbers at particular periods." While not going so far as the authors in saying (p. 139) that "the absence of B. coli demonstrates the harmlessness of a water as far as bacteriology can prove it," it is certain that "its numbers form a reasonably close index of the amount of pollution," and that (p. 140) when it is found in such abundance as to be isolated from 1 cc. of water, "it is reasonable proof of serious pollution." The Jackson bile medium is preferred to the MacConkey (p. 147). A sentence on p. 159 would seem to imply that search for streptococci was a routine procedure in England, whereas owing to the time involved it is mostly used only in special cases. While not under-rating chemical analysis the authors give in chapter X. several instances where bacterial tests had greater delicacy. In chapter XI. the disinfection or sterilization of sewage is discussed. An appendix gives plain receipts for preparing and working the various media. Sedgwick's nitrogen cycle on p. 5 would make a good lecture diagram. Considerable additions have been made as to the problems of self-purification, the isolation of the typhoid bacillus, and the significance of other bacteria than coli, and a new chapter has been introduced on the bacteriology of sewage and effluents.

S. R.

* Elements of Water Bacteriology, with special reference to sanitary water analysis, by S. C. Prescott and C. A. Winslow, Massachusetts Institute of Technology. John Wiley & Sons, New York; Chapman & Hall, London. 2nd edition, rewritten, 1908. Small 8vo., 258 pp.

M

METHODS AND DEVICES FOR BACTERIAL TREATMENT OF SEWAGE.*

This work, according to the author, is written "from the view-point of the civil engineer" of a modern type, who utilizes the pioneer scientific work, and avails himself both of so-called "theory" and "practice." He frankly acknowledges "sources of information" in chapter II., and then describes, with comments and illustrations which make the text plain, the growth and divergences of sewage treatment, the construction and working of sewage plant, and his actual experience of difficulties that may be encountered. Original papers and documents are quoted *in extenso*, and make this a very useful compilation with an intelligent commentary. The summary of principles regarding the design of purification works (chapter IX) is equally good. The "patent" question is very usefully dealt with. S. R.

ARTICLES RELATING TO PUBLIC HEALTH,

Appearing in the chief British and Foreign Journals and Transactions.

The articles referred to in this list are as far as possible collected and filed in the Library of the Institute for the use of the Members and Associates.

Hygiene of Special Classes, Trades, and Professions; and Municipal Administration.

PONTING, C. E. New Gymnasium, Marlborough College. *The Builder*, 16th May, 1908, p. 577.

Description of building and plan.

RILEY, W. E., F.R.I.B.A. London County Council Technical College. *The Builder*, 16th May, 1908, p. 575.

Description of building with plans and external view.

"ENGINEERING RECORD." A Bacteriological Method of Determining the Efficiency of Street Cleaning, 8th August, 1908, p. 161.

Description of cleansing machine used in the City of New York, and the mode of using cultures to test the efficiency.

Building Materials, Construction, and Machinery.

"A CEMENT MANUFACTURER." The Ageing of Concrete. *The Builder*, 20th June, 1908, p. 715.

Description of experiments and tests of cement and sand in various proportions at end of varying periods, with tables.

KINDER, T. B. Masonry Work in Zero Weather. *The Builder*, 13th June, 1908, p. 690.

Description of building operations for a bridge in New Brunswick in a temperature 12° below zero. Illustrated with photographs.

"ENGINEERING RECORD." Refuse Disposal in America, 25th July, 1908, p. 85.

Description of the offensive means at present adopted, and recommending that the British methods should be followed.

Heating, Lighting, and Ventilating.

GASTER, LEON. Illumination and Hygiene. *Journ. R. Soc. Arts*, Vol. LVI., No. 2,909, 1908, pp. 888–890.

Notices the influence of illumination on health, in works and schools, and the ill-effect of bad lighting.

* Methods and Devices for Bacterial Treatment of Sewage, by W. M. Venable, M.S., Member of the American Societies of Civil and Electrical Engineers. 1st edition, 1908. John Wiley & Sons, New York; Chapman & Hall, London. 8vo., 236 pp. 49 illustrations and 3 plates. 12s. 6d.

FORTHCOMING MEETINGS.

Sessional Meetings.

York, October 17th, 11 a.m. Discussion on "The Architecture and Sanitation of Elementary School Buildings," to be opened by J. Osborne Smith, F.R.I.B.A. Visits to Council Schools and the Waterworks, where the Jewell System of Filtration is to be seen.

Durham, November 14th. Discussion on "The Health Visitor and the School Nurse in relation to Sanitary Administration," to be opened by H. Renney, M.D., D.P.H., Medical Officer of Health, Sunderland. Visits will be made to the Cathedral and Castle, and to Finchale Abbey.

Lecture to the Institute.

Wednesday, November 18th, at 5 p.m. "The Results of Sanitation in the Efficiency of Armies in Peace and War," by Surgeon-General Sir Alfred Keogh, K.C.B., LL.D., M.D., Director-General, Army Medical Service. His Grace the Duke of Northumberland, K.G., President of the Institute, in the chair.

Examinations.

Inspectors of Meat and Other Foods—
Cardiff, October 2nd and 3rd.
Birmingham, October 23rd and 24th.
Sheffield, November 13th and 14th.

In Sanitary Science as applied to Buildings and Public Works, for Inspectors Qualifying for Membership, for Inspectors of Nuisances, in Hygiene in its Bearing on School Life, and for Women Health Visitors and School Nurses—
Nottingham, October 9th and 10th.
Perth, October 16th and 17th.
Liverpool, October 30th and 31st.
Bristol, November 6th and 7th.
Newcastle, November 20th and 21st.
London, November 27th and 28th.

Calendar for October and November, 1908.

As far as at present arranged.

OCTOBER.

1 Th. Lecture—Meat Inspectors' Course, at 6.30 p.m.

1 Th. Lecture to Sanitary Officers, at 7 p.m. Duties of a Sanitary Inspector—General, B: Indoor, by A. Wellesley Harris, M.R.C.S., D.P.H.

2 F. Lecture to Sanitary Officers, at 7 p.m. Duties of a Sanitary Inspector—C: Offensive Trades and Trade Nuisances, etc., by A. Wellesley Harris, M.R.C.S., D.P.H.

2 F. } Examination for Inspectors of Meat and other Foods, Cardiff.
3 S. }

3 S. Inspection and Demonstration at the Southwark and Vauxhall Water Works, Hampton, at 2.30 p.m. Conducted by J. W. Restler, M.Inst.C.E.

5 M. Lecture to Sanitary Officers, at 7 p.m. "Infectious Diseases," by Prof. A. Bostock Hill, M.D., M.SC., M.O.H. Warwickshire C.C.

6 Tu. Lecture to Sanitary Officers, at 7 p.m. "Methods of Disinfection," by Prof. A. Bostock Hill, M.D., M.SC.

7 W. Inspection and Demonstration at John Knight, Ltd., Soap Works, Silvertown, at 3 p.m.

7 W. Lecture to Sanitary Officers, at 7 p.m. "Elementary Statistics," by Prof. A. Bostock Hill, M.D., M.SC.

8 Th. Lecture to School Teachers, at 7 p.m. "Physiology," by Prof. H. R. Kenwood, M.B., D.P.H.

8 Th. Demonstration of Book-keeping as carried out in a Sanitary Inspector's Office, at the Public Health Office, Town Hall, Upper Street, Islington, N., at 6 p.m., by James R. Leggatt, Supt., Public Health Department, Borough of Islington.

9 F. Lecture—Meat Inspectors' Course, at 6.30 p.m.

9 F. Lecture to Sanitary Officers, at 7 p.m. "Elementary Science: Physics, Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

9 F. } Examinations Nottingham.
10 S. }

10 S. Inspection and Demonstration at the Lambeth Disinfecting Station, at 2.30 p.m. Conducted by J. Priestley, M.D., D.P.H., M.O.H. Lambeth.

12 M. Demonstration on Meteorological Instruments in the Parkes Museum, at 6 p.m., by the Director, E. White Wallis, F.S.S.

12 M. Lecture to School Teachers, at 7 p.m. "Physiology," by Prof. H. R. Kenwood, M.B., D.P.H.

12 M. Lecture to Sanitary Officers, at 7 p.m. "Elementary Science: Physics, Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

13 Tu. Lecture to Sanitary Officers, at 7 p.m. "Elementary Science: Physics, Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

14 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt. Public Health Department, Borough of Islington.

14 W. Lecture to Sanitary Officers, at 7 p.m. "Elementary Science: Physics, Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

14 W. Lecture to School Teachers, at 7 p.m. "Foods," by Col. J. Lane Notter, R.A.M.C., M.A., M.D., D.P.H.

16 F. Lecture to School Teachers, at 7 p.m. "Clothing," by Col. J. Lane Notter, R.A.M.C., M.A., M.D., D.P.H.

16 F. Lecture to Sanitary Officers, at 7 p.m. "Elementary Science: Physics, Chemistry," by E. J. Steegmann, M.B., M.R.C.S., D.P.H.

16 F. } Examinations—Perth.
17 S. }

17 S. **Sessional Meeting,** YORK, 11 a.m. Discussion on "The Architecture and Sanitation of Elementary School Buildings, to be opened by J. Osborne Smith, F.R.I.B.A. Visits to the Council Schools and the Waterworks.

17 S. Inspection and Demonstration at the Sewage and Destructor Works, Ealing, at 2.15 p.m. Conducted by Charles Jones, M.INST.C.E., Borough Engineer and Surveyor.

17 S. Demonstration—Meat Inspectors' Course, at 2 p.m.

19 M. Demonstration on Building Materials and Construction in the Parkes Museum, at 6 p.m.

19 M. Lecture to School Teachers, at 7 p.m. "School Buildings, Water Supply, etc.," by J. Osborne Smith, F.R.I.B.A.

19 M. Lecture to Sanitary Officers, at 7 p.m. "Calculations, Measurements, Plans and Sections," by Henry Adams, M.INST.C.E.

20 Tu. Lecture to Sanitary Officers, at 7 p.m. "Building Materials," by H. D. Searles-Wood, F.R.I.B.A.

21 W. Inspection and Demonstration in the District of Chiswick, at 3 p.m. Conducted by J. H. Clarke, Chief Sanitary Inspector, Chiswick.

22 Th. Lecture to Sanitary Officers, at 7 p.m. "Sanitary Building Construction and Planning: Soil and Local Physical Conditions," by H. D. Searles-Wood, F.R.I.B.A.

22 Th. Lecture—Meat Inspectors' Course, at 6.30 p.m.

23 F. Lecture to School Teachers, at 7 p.m. "School Furniture," by Prof. H. R. Kenwood, M.B., D.P.H.

23 F. Lecture—Sanitary Science Course, at 7 p.m. "Sanitary Building Construction, Advanced," by H. D. Searles-Wood, F.R.I.B.A.

23 F. } Examinations—Birmingham.
24 S. }

24 S. Demonstration at a School on the General Planning of Schools and their Sanitary Arrangements and Fittings, by J. Osborne Smith, F.R.I.B.A.

24 S. Inspection and Demonstration at the Aylesbury Dairy Company's premises, St. Petersburgh Place, Bayswater, W., at 2.30 p.m.

26 M. Demonstration on Baths and Lavatories in the Parkes Museum, at 6 p.m.

26 M. Lecture to Sanitary Officers, at 7 p.m. "Sanitary Appliances," by W. C. Tyndale, M.INST.C.E.

27 Tu. Demonstration on Waste Preventers and Water Closets in the Parkes Museum, at 6 p.m.

27 Tu. Lecture to Sanitary Officers, at 7 p.m. "Ventilation, Warming, and Lighting," by J. Osborne Smith, F.R.I.B.A.

28 W. Inspection and Demonstration at L.C.C. Municipal Lodging House, Kemble Street, Drury Lane, W.C., at 2.30 p.m., and at 4 p.m. Inspection of Messrs. Callard, Stewart, and Watts' Bakery, Little Dean Street, Soho.

28 W. Demonstration on Pipe Joints, etc., and Drain Testing Appliances, in the Parkes Museum, at 6 p.m.

28 W. Lecture to School Teachers, at 7 p.m. "Physical Exercises," by P. Boobbyer, M.D.

28 W. Lecture to Sanitary Officers, at 7 p.m. "Details of Plumbers' Work," by J. Wright Clarke.

30 F. Lecture to Sanitary Officers, at 7 p.m. "House Drainage," by W. C. Tyndale, M.INST.C.E.

30 F. } Examinations—Liverpool.
31 S. }

31 S. Demonstration—Meat Inspectors' Course, at 2 p.m.

31 S. Inspection and Demonstration in the District of Chiswick, at 3 p.m. (number limited). Conducted by J. H. Clarke, Chief Sanitary Inspector, Chiswick.

NOVEMBER.

2 M. Lecture to Sanitary Officers, at 7 p.m. "Water: Composition, Pollution, and Purification," by Prof. H. R. Kenwood, M.B., D.P.H.

3 Tu. Lecture to Sanitary Officers, at 7 p.m. "Water Supply: Sources of Supply and Distribution," by J. E. Worth, M.INST.C.E.

4 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Superintendent, Public Health Department, Borough of Islington.

4 W. Lecture to Sanitary Officers, at 7 p.m. "Sewerage," by J. E. Worth, M.INST.C.E.

5 Th. Demonstration on House Drainage in the Parkes Museum, at 6 p.m.

5 Th. Lecture to School Teachers, at 7 p.m. "Physical Conditions Affecting Health in Schools," by James Kerr, M.A., M.D., D.P.H.

5 Th. Lecture to Sanitary Officers, at 7 p.m. "Sewage Disposal," by J. E. Worth, M.INST.C.E.

6 F. Lecture to Sanitary Officers, at 7 p.m. "Scavenging: Disposal of House Refuse," by J. E. Worth, M.INST.C.E.

6 F. Lecture—Meat Inspectors' Course, at 6.30 p.m.

6 F. } Examinations—Bristol.
7 S. }

7 S. Inspection and Demonstration at the Camberwell Infirmary, Brunswick Square, Peckham Road, S.E., at 2.15 p.m. Conducted by Edwin T. Hall, V.-P.R.I.B.A.

9 M. Demonstration on Water Supply in the Parkes Museum, at 6 p.m.

9 M. Lecture to Sanitary Officers, at 7 p.m. "Signs of Health and Disease in Animals destined for Food, when alive and after slaughter: Tuberculin and other Tests," by Major J. A. Meredith, F.R.C.V.S.

9 M. Lecture to School Teachers, at 7 p.m. "Physical Conditions Affecting Health in Schools," by James Kerr, M.A., M.D., D.P.H.

10 Tu. Lecture to Sanitary Officers, at 7 p.m. "The Names and Situations of the Organs of the Body in Animals," by Major J. A. Meredith, F.R.C.V.S.

11 W. Inspection and Demonstration at Harrison & Barber's Knackers' Yard, Winthrop Street, Whitechapel, E., at 3 p.m. Conducted by R. Glover, F.R.C.V.S.

11 W. Lecture to Sanitary Officers, at 7 p.m. "Practical Methods of Stalling and Slaughtering Animals," by Major J. A. Meredith, F.R.C.V.S.

12 Th. Lecture to Sanitary Officers, at 7 p.m. Diseased Meat, with a Demonstration of Morbid Specimens collected from Meat Markets, by James King, M.R.C.V.S.

12 Th. Demonstration to Commissioned Officers and Professional Men, at 11 a.m., at the Metropolitan Cattle Market, by James King, M.R.C.V.S.

12 Th. Inspection and Demonstration at the Metropolitan Cattle Market, York Road, N., at 2 p.m. Conducted by James King, M.R.C.V.S.

13 F. Lecture to Sanitary Officers, at 7 p.m. "The Appearance and Character of Fresh Meat, Organs, Fat, Blood, Fish, Poultry, Milk, Fruit, Vegetables, and other food, and the conditions rendering them, or preparations of them, fit or unfit for human consumption. Preserving and Storing Meat and other foods," by E. Petronell Manby, B.A., M.D., D.P.H.

13 F. } Examination for Inspectors of Meat and other Foods, Sheffield.
14 S. }

14 S. **Sessional Meeting,** Durham. Discussion on "The Health Visitor and the School Nurse in relation to Sanitary Administration," to be opened by H. Renney, M.D., D.P.H., M.O.H. Sunderland. Visits will be made to the Cathedral and Castle, and to Finchale Abbey.

14 S. Demonstration—Meat Inspectors' Course, at 2 p.m.

14 S. Demonstration to Commissioned Officers and Professional Men, at 11 a.m., at the Metropolitan Cattle Market, by James King, M.R.C.V.S.

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17 Tu. Inspection and Demonstration in Fish Inspection at Billingsgate Market, at 8.30 a.m., conducted by J. Roberts, Chief Fish Inspector, Fishmongers' Company.

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18 W. **Lecture to the Institute,** at 5 p.m. "The Results of Sanitation in the Efficiency of Armies in Peace and War," by Surgeon-General Sir Alfred Keogh, K.C.B., LL.D., M.D., Director-General, Army Medical Service. His Grace the Duke of Northumberland, K.G., President of the Institute, in the Chair.

19 Th. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., at the Parkes Museum, by James King, M.R.C.V.S.

20 F. Lecture—Meat Inspectors' Course, at 6.30 p.m.

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23 M. Lecture to Commissioned Officers and Professional Men, at 5 p.m., on "Tinned and Potted Food," by Prof. H. R. Kenwood, M.B., D.P.H.

CONTRIBUTIONS AND ADDITIONS TO LIBRARY.

*** *For publications of Societies and Institutions, etc., see under "Academies."*

ACADEMIES (British).

The British Institute of Social Service. Third Annual Report, 1907. 36 pp., 8vo. London, 1908. *The Institute.*

The Imperial College of Science and Technology. Calendar for the Session, 1908-9. 80 pp., 8vo. London, 1908. *The College.*

Berne. Die Betriebe und die Zahl der darin beschäftigten Personen. 626 pp., 4to. Berne, 1908.

——— Resultats der Recensement Fédéral. 63 pp., 4to. Berne, 1908. *Bureau de Statistique.*

Brindley, *James J.* Death and its Verification. 56 pp., 8vo. London, 1908. *Rebman, Ltd. (Publishers).*

Buchan, *G. F., M.B., D.P.H.* Preliminary Report on Mussels and Typhoid Fever. 28 pp., 8vo. Birmingham, 1908. *The Author.*

Factories and Workshops. Annual Report of the Chief Inspector of Factories and Workshops for the Year 1907. 321 pp., fcp. London, 1908. *The Chief Inspector.*

Lumley, *W. G. and E.* Lumley's Public Health Seventh Edition, Vol. I. and II. 2,444 pp., 8vo. London, 1908. *The Publishers.*

Manchester. Bye-Laws with respect to New Streets and Buildings, etc. 1908. 79 pp., 8vo. *T. de Courcy Meade, M.Inst.C.E.*

MEDICAL OFFICERS OF HEALTH & OTHER SANITARY REPORTS.

Aberdeen, July, 1908 (San. Insp.) .. *Kenneth Cameron.*
Bradford, 1907 .. .. .. *W. Arnold Evans, M.D., B.Sc.*
Calcutta, 1907 .. .. .. *T. Frederick Pearse, M.D., F.R.C.P.*
Lanark C.C., 1907 .. .. .. *J. T. Wilson, M.D.*
Lewisham, 1907 .. .. .. *A. Wellesley Harris, M.R.C.S., D.P.H.*
Middlesex C.C., 1907 .. .. .. *C. W. F. Young, M.D., D.P.H.*
Wolverhampton, 1907 .. .. *H. Malet, B.A., M.D.*

Metropolitan Water Board. Fifth Annual Report of the Metropolitan Water Board. 114 pp., 8vo. London, 1908. *The Board.*

New Jersey. Annual Report of the Board of Health of the State of New Jersey, 1907, and of the Bureau of Vital Statistics. 432 pp., 8vo. Trenton, New Jersey, 1908. *The Board.*

Nottingham. Report on the Medical Inspection of School Children attending Public Elementary Schools under the Education (Administrative Provisions) Act, 1907, by Dr. P. Boobbyer. *P. Boobbyer, M.D., M.S.*

Nottinghamshire. Report upon the Water Supplies of Nottinghamshire. 23 pp., 8vo. Nottingham, 1908. *Henry Handford, M.D., F.R.C.P.*

Palmberg, *Prof. Albert.* The Control of Tuberculosis in Finland. *The Author.*

Paris. Annales des Ponts et Chaussées. 193 pp., 8vo. Paris, 1907.
E. Bernard (editor).

Pfeiffer, *Dr. A.* Dreiundzwanzigster Jahresbericht über die Fortschritte und Leistungen auf dem Gebiete der Hygiene, Jahrgang 1908. 593 pp., 4to. Braunschweig, 1908. *The Author.*

Pistor, *Moritz, and* **Merkel,** *Sigmund.* Deutsche Vierteljahrsschrift für öffentliche Gesundheitspflege, Organ "Deutschen Vereins für öffentliche Gesundheitspflege." 397 pp., 4to. Braunschweig, 1908. *The Authors.*

Porter, *Charles, M.D., B.Sc* School Hygiene and the Laws of Health. 335 pp., 8vo. London, 1908. *Messrs. Longmans, Green, & Co. (Publishers).*

Prescott, *Samuel C., and* **Winslow,** *Charles E. A.* Elements of Water Bacteriology, with special reference to Sanitary Water Analysis. 258 pp., 8vo. London and New York, 1908. *J. Wiley & Sons (publishers).*

Rand Water Board. Third Annual Report of the Rand Water Board to the Colonial Secretary of the Transvaal. 61 pp., feap. Johannesburg, 1908.
D. C. Leitch, M.Inst.C.E.

Ravenhill, *Miss A.* Some Results of an Investigation into Hours of Sleep among Children in the Elementary Schools of England. 25 pp., 8vo. Leipzig, 1908. *The Author.*

Registrar-General for England and Wales. Supplement to the Sixty-Fifth Annual Report of Births, Deaths, and Marriages in England and Wales. 172 pp., 8vo. London, 1908. *The Registrar General.*

Reid, *George, M.D.* Practical Sanitation. Fourteenth Edition. 352 pp., 8vo. London, 1908. *Charles Griffin & Co., Ltd. (Publishers).*

Seaton, *Edward C., M.D., D.P.H.* Report on the Compulsory Notification and Hospital Isolation System of Infectious Diseases as applied to Scarlet Fever or Scarlatina. 52 pp., 8vo. Kingston-on-Thames, 1908. *The Author.*

Selter-Bonn, *Dr. Med.* Schulhygienische Fragen auf dem Internationalen Kongress für Hygiene und Demographie in Berlin. 135 pp., 8vo. Leipzig, 1908. *The Author.*

Southport. Report and Results of Observations for the Year 1907, with an Appendix, by Joseph Baxendell. *The Author.*

St. Thomas's Hospital. Reports, Vol. XXXV., 1906. 500 pp., 8vo. London, 1908. *The Hospital.*

Sutcliffe, *J. D.* Factory and Workshop Warming and Ventilation, with special reference to Engineering, Motor, and Cycle Works. 48 pp., 8vo. London and Manchester, 1908. *Sherratt & Hughes (publishers).*

Urbanora. The World's Educator: Catalogue of Scientific and Educational Subjects. 252 pp., 8vo. London, 1908. *Charles Urban Trading Co., Ltd.*

Western Australia. Meat Inspection and Diseases of Animals in Western Australia for the Year ending 30th June, 1907. *J. Burton Cleland, M.D.*

Women Sanitary Inspectors' Association. Annual Report, 1907-08. 18 pp., 8vo. London, 1908. *The Association.*

York Health and Housing Reform Association. The Milk Supply of York. 19 pp., 8vo. York, 1908. *The Association.*

THE ROYAL SANITARY INSTITUTE.

ARTICLES RELATING TO PUBLIC HEALTH,*

Appearing in the chief British and Foreign Journals and Transactions.

The articles referred to in this list are as far as possible collected and filed in the Library of the Institute for the use of the Members and Associates.

Hygiene of Special Classes, Trades, and Professions. Municipal Administration.

BOULNOIS, H. PERCY, M.Inst.C.E. Road making in relation to street cleansing. *Surveyor*, July 10th, 1908, p. 53.

Reasons for excessive dust—origin of dust—macadamised roads—dust laying preparations—paved roads—requirements for an ideal road for cleansing purposes.

FORREST, G. TOPHAM, M.S.A. County Council Schools: their general arrangement and method of building. *Building News*, Feb. 14th, 1908, pp. 243-44, and Feb. 21st, 1908, pp. 273-74.

School legislation—sanitation—system of closets in schools—water supply—planning—sanitary conveniences.

FRANKENBURGER, DR. A. The institutions and the work of the Association for the Prevention of Tuberculosis at Nuremberg during the year 1907. *Deutsche Vierteljahrsschrift für öffentliche Gesundheitspflege*, Vol. 40, Part 4, p. 577.

This is an interesting report on the work of the Nuremberg Association for the Prevention of Tuberculosis during 1907, with eight photographic prints of the two sanatoria in use. It concludes by stating that the satisfactory results obtained by the treatment have been acknowledged by all medical men who have sent patients.

HILL, PROFESSOR LEONARD, F.R.S. Breathing Apparatus for use in Mines. *Engineering*, Jan. 17th, 1908, pp. 93-4.

Oxygen—choke-damp—fire-damp—influence of deoxygenated air on man—excess of oxygen on man—carbonic acid—carbon monoxide, &c.—breathing apparatus—equipment and speed of dressing—results of apparatus as used by experienced and inexperienced men.

Water Supply, Sewerage, and Refuse Disposal.

ALLSOP, R. OWEN. Well-boring and Water Supply. *Building News*, July 31st, 1908, pp. 141-42, Aug. 7th, 1908, p. 180-81, Aug. 14th, 1908, pp. 216-17, Aug. 21st, 1908, 248-49, Aug. 28th, 1908, p. 288, Sep. 4th, 1908, pp. 322-23, Sept. 18th, 1908, p. 395, and Sept. 25th, 1908, pp. 426-27, etc.

History of well-boring—percussion well-boring—artesian wells—essentials

* Members or Associates wishing to file or catalogue these Titles can, on application, be supplied with excerpt copies for this purpose.

for good well-boring—power required to pump water—water storage—deep well pumps—boring tubes, etc.

ALDWINCKLE, T. W., F.R.I.B.A. Public Baths and Washhouses. *Surveyor*, March 6th, 1908, pp. 316–18.

Site—arrangement of buildings—details of swimming baths—conversion into public hall when not in use. Wash houses—warming and ventilation—supply of hot water—stores and conveniences, &c.

ANGEL, ROBERT J., M.Inst.C.E., A.R.I.B.A. Continuous Filtration of Bath Water: a description of its working. *Surveyor*, March 13th, 1908, pp. 344–45.

Continuous filtration as opposed to repeated renewals—its advantages—installation of plant at Rotherithe—comparisons of working expenses—bacteriological analysis—description of the scheme.

BURGESS, PHILIP, Assoc.M.Am.Soc.C.E., *Ohio, U.S.A.* The Development of the Mechanical Filter Plant. *Surveyor*, April 24th, 1908, pp. 495–6, and May 1st, 1908, pp. 517–8.

Historical—main features of plants—first mechanical filter plants—filters—coagulant and methods of application—clear well—cost of filtration and results obtained.

DUNCANSON, THOMAS, M.Inst.C.E. Water Supplies from Catchment Areas. *Surveyor*, May 1st, 1908 (Supplement).

Duration of supply to be provided for—yield of a catchment area—site for reservoir—compensation water—filtration.

HANSEN, PAUL, Assistant Engineer, Ohio, *U.S.A.* City Wastes Disposal and Street Cleaning. *Surveyor*, March 27th, 1908, pp. 396–97.

Problems in the United States—garbage and food wastes—cremation—reduction of garbage by driving off moisture and extracting grease—night soil—street cleansing.

HETTERSDORF, DR. F. The Self-purification of Rivers. *Deutsche Vierteljahrsschrift für öffentliche Gesundheitspflege*, Vol. 40, Part 4, p. 615.

The author examines this question in a very thorough manner, and comes to the conclusion that there are many points on which we require further information. The process is a slow one.

HILL, H. ASHTON, M.Inst.C.E. Wells and Boreholes for Town Water Supply. *Surveyor*, July 17th, 1908, pp. 86–7.

Legal right to take underground water—analytical conditions of underground water—geological and meteorological conditions—relative merits of wells and boreholes—notes on construction.

HORTON, THEODORE, C.E. Sewage Disposal for institutions and small communities (U.S.A.) *Surveyor*, Jan. 17th, 1908, pp. 56–8.

Definition of sewage—domestic sewage—methods of sewage disposal—European and American methods—septic tank—filters—standard of purity for effluents—special features of modern plant for small communities.

MEETINGS HELD.

York.—The meeting was held in the Council Chamber, Guildhall, on October 17th, when a discussion on "The Architecture and Sanitation of Elementary School Buildings" was opened by J. Osborne Smith, F.R.I.B.A. The chair was taken by H. D. Searles Wood, F.R.I.B.A. The Right Hon. the Lord Mayor (Ald. Sir Joseph Sykes Rymer) and the Sheriff welcomed the members. Visits were made to two Elementary Schools in the City and the York Waterworks, where the Jewell System of Filtration was seen, and the members were entertained to tea by the Lord Mayor.

Examinations.

The following Examinations were held:—

Examination Qualifying for Membership.

Nottingham, Oct. 9th and 10th. 1 Candidate: no Certificate granted.

Sanitary Science as applied to Buildings and Public Works.

Nottingham, Oct. 9th and 10th. 3 Candidates: no Certificates granted.
Perth, Oct. 16th and 17th. 1 Candidate: 1 Certificate granted.

Women Health Visitors and School Nurses.

Nottingham, Oct. 9th and 10th. 1 Candidate: 1 Certificate granted.
Perth, Oct. 16th and 17th. 3 Candidates: 3 Certificates granted.

Inspectors of Nuisances.

Nottingham, Oct. 9th and 10th. 31 Candidates: 12 Certificates granted.
Perth, Oct. 16th and 17th. 5 Candidates: 2 Certificates granted.

Inspectors of Meat and other Foods.

Cardiff, Oct. 2nd and 3rd. 6 Candidates: 2 Certificates granted.
Birmingham, 23rd and 24th. 4 Candidates: 1 Certificate granted.

Candidates who have received Certificates.

Sanitary Science as applied to Buildings and Public Works.

Sidle, Randolph Sefton.

Women Health Visitors and School Nurses.

Gordon, Annie Macarthur.
Lindsay, Jean R.
MacWilliam, Madeline.
Thompson, Georgina Sarah Jane.

Inspectors of Nuisances.

Benn, Percy Arthur.
Brown, Mabel.
Bull, Thomas.
Deakin, Joseph.
Dobson, George.
Hopper, Walter George.
Larmour, William John.
Pearson, George Parker.
Quest, William.
Richardson, Eleanor.
Spence, Norman Findley.
Watt, Alexander.
Wilkinson, Mary Sabina.
Wood, Horace.

Inspectors of Meat and Other Foods.

Jenkins, Henry Llewellyn.
Hockley, Charles.
Smith, George Henry.

FORTHCOMING MEETINGS

Sessional Meetings.

Durham, November 14th. Discussion on "The Health Visitor and the School Nurse in relation to Sanitary Administration," to be opened by H. Renney, M.D., D.P.H., Medical Officer of Health, Sunderland. Visits will be made to the Cathedral and Castle.

Lecture to the Institute.

Wednesday, November 18th, at 5 p.m. "The Results of Sanitation in the Efficiency of Armies in Peace and War," by Surgeon-General Sir Alfred Keogh, K.C.B., LL.D., M.D., Director-General, Army Medical Service. His Grace the Duke of Northumberland, K.G., President of the Institute, will preside.

Examinations.

Inspectors of Meat and Other Foods—

Sheffield, November 13th and 14th.
London, December 18th and 19th.

In Sanitary Science as applied to Buildings and Public Works, for Inspectors Qualifying for Membership, for Inspectors of Nuisances, in Hygiene in its Bearing on School Life, and for Women Health Visitors and School Nurses—

Bristol, November 6th and 7th.
Newcastle, November 20th and 21st.
London, November 27th and 28th.
Manchester, December 11th and 12th.

Calendar for November and December, 1908.

As far as at present arranged.

NOVEMBER.

2 M. Lecture to Sanitary Officers, at 7 p.m. "Water: Composition, Pollution, and Purification," by Prof. H. R. Kenwood, M.B., D.P.H.

3 Tu. Lecture to Sanitary Officers, at 7 p.m. "Water Supply: Sources of Supply and Distribution," by J. E. Worth, M.INST.C.E.

4 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Superintendent, Public Health Department, Borough of Islington.

4 W. Lecture to Sanitary Officers, at 7 p.m. "Sewerage," by J. E. Worth, M.INST.C.E.

5 Th. Demonstration on House Drainage in the Parkes Museum, at 6 p.m.

5 Th. Lecture to School Teachers at 7 p.m. "Physical Conditions Affecting Health in Schools," by James Kerr, M.A., M.D., D.P.H.

5 Th. Lecture to Sanitary Officers, at 7 p.m. "Sewage Disposal," by J. E. Worth, M.INST.C.E.

6 F. Lecture to Sanitary Officers, at 7 p.m. "Scavenging: Disposal of House Refuse," by J. E. Worth, M.INST.C.E.

6 F. Lecture—Meat Inspectors' Course, at 6.30 p.m.

6 F.
7 S. } Examinations Bristol.

7 S. Inspection and Demonstration at the Camberwell Infirmary, Brunswick Square, Peckham Road, S.E., at 2.15 p.m. Conducted by Edwin T. Hall, V-P.R.I.B.A.

9 M. Demonstration on Water Supply in the Parkes Museum, at 6 p.m.

9 M. Lecture to Sanitary Officers, at 7 p.m. "Signs of Health and Disease in Animals destined for Food, when alive and after slaughter; Tuberculin and other Tests," by Major J. A. Meredith, F.R.C.V.S.

9 M. Lecture to School Teachers, at 7 p.m. "Physical Conditions Affecting Health in Schools," by James Kerr, M.A., M.D., D.P.H.

10 Tu. Lecture to Sanitary Officers, at 7 p.m. "The Names and Situations of the Organs of the Body in Animals," by Major J. A. Meredith, F.R.C.V.S.

11 W. Inspection and Demonstration at Harrison & Barber's Knackers' Yard, Winthrop Street, Whitechapel, E., at 3 p.m. Conducted by R. Glover, F.R.C.V.S.

11 W. Lecture to Sanitary Officers, at 7 p.m. "Practical Methods of Stalling and Slaughtering Animals," by Major J. A. Meredith, F.R.C.V.S.

12 Th. Demonstration to Commissioned Officers and Professional Men, at 11 a.m., at the Metropolitan Cattle Market, by James King, M.R.C.V.S.

12 Th. Inspection and Demonstration at the Metropolitan Cattle Market, York Road, N., at 2 p.m. Conducted by James King, M.R.C.V.S.

12 Th. Lecture to Sanitary Officers, at 7 p.m. Diseased Meat, with a Demonstration of Morbid Specimens collected from Meat Markets, by James King, M.R.C.V.S.

13 F. Lecture to Sanitary Officers, at 7 p.m. "The Appearance and Character of Fresh Meat, Organs, Fat, Blood, Fish, Poultry, Milk, Fruit, Vegetables, and other food, and the conditions rendering them, or preparations of them, fit or unfit for human consumption. Preserving and Storing Meat and other foods," by E. Petronell Manby, B.A., M.D., D.P.H.

13 F.
14 S. } Examination for Inspectors of Meat and other Foods, Sheffield.

14 S. **Sessional Meeting**, DURHAM. Discussion on "The Health Visitor and the School Nurse in relation to Sanitary Administration," to be opened by H. Renney, M.D., D.P.H., M.O.H. Sunderland. Visits will be made to the Cathedral and Castle.

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23 M. Lecture to Commissioned Officers and Professional Men, at 5 p.m., on "Tinned and Potted Food," by Prof. H. R. Kenwood, M.B., D.P.H.

24 Tu. Demonstration—Meat Inspectors' Course, at 6.30 p.m., on "Foods other than Meat," by Col. J. Lane Notter, R.A.M.C.

24 Tu. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., at the Parkes Museum, by James King, M.R.C.V.S.

25 W. Lecture to Commissioned Officers and Professional Men, at 5 p.m., on "Milk, Butter, and Cheese," by Prof. H. R. Kenwood, M.B., D.P.H.

26 Th. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., at the Parkes Museum, by James King, M.R.C.V.S.

27 F. Demonstration—Meat Inspectors' Course, at 6.30 p.m., on "Foods other than Meat," by Col. J. Lane Notter, R.A.M.C.

27 F. } Examinations—London.
28 S. }

28 S. Demonstration to Commissioned Officers and Professional Men, at 11 a.m., at the Metropolitan Cattle Market, by James King, M.R.C.V.S.

28 S. Demonstration—Meat Inspectors' Course, at 2 p.m.

DECEMBER.

1 Tu. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., at the Parkes Museum, by James King, M.R.C.V.S.

3 Th. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Fish, Eggs, Tea, Coffee, Cocoa and Chocolate, Lime Juice, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

4 F. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Wheat, Rice, Arrowroot, and other Grains, Potatoes, Flour, Bread, Biscuits, Sugars, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

4 F. Lecture—Meat Inspectors' Course, at 6.30 p.m.

5 S. Demonstration to Commissioned Officers and Professional Men at 11 a.m. at the Metropolitan Cattle Market, by James King, M.R.C.V.S.

7 M. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Succulent Vegetables and Fruits, Jams; the Condiments—Vinegar, Pepper, Mustard; Prepared, Concentrated, and Preserved Foods, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

8 Tu. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., at the Parkes Museum, by James King, M.R.C.V.S.

10 Th. Demonstration to Commissioned Officers and Professional Men at a Factory for Preparation of Concentrated and Preserved Foods.

10 Th. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Alcoholic Beverages—Beer, Wines, Whisky, Brandy, etc., by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

11 F. } Examinations—Manchester.
12 S. }

12 S. Demonstration—Meat Inspectors' Course, at 2 p.m.

18 F. } Examination for Inspectors of Meat and other Foods, London.
19 S. }

25 F. } **Christmas Day** } Museum and Library closed.
26 S. } **Boxing Day** }

LIST OF HON. FELLOW, FELLOW, MEMBERS, AND ASSOCIATES ELECTED,

OCTOBER, 1908.

HONORARY FELLOW.

Reg. No. | Date of Election.

74 1908. Oct. MARTINS, Professor João Lopes da Silvà, Junr., *Rua da Rainha 338, Porto Portugal.*

FELLOW.

2321 1908. Oct. PLYMOUTH, The Right Hon. The Earl of, P.C., 54, *Mount St., W. (and St. Fagan's Castle, Cardiff).*

MEMBERS.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.
* Marked thus have passed the Examination in Sanitary Science as applied to Buildings and Public Works.

Reg. No. | Date of Election.

2307 1908. Oct. ADAMS, Harry Archer, *Chief Quantity Surveyor, Public Works Dept., Pretoria.*

2310 1908. Oct. *BARRATT, Ralph William, 25, *Stoke Road, Gosport, Hants.*

2308 1908. Oct. ‡BRIDGES, Oswald Arthur, *Engineer and Surveyor, Bognor, Sussex.*

[illegible] 1908. Oct. BUCKLEY, George Granville, M.D., CH.B., D.P.H., (*M.O.H.*), *Municipal Offices, Crewe.*

2311 1908. Oct. CARRUTHERS, David Allan, M.D., D.P.H., *County Education Offices, Aylesbury.*

2311 1908. Oct. CUTLER, Henry J., P.A.S.I., 32, *Arlington Gardens, Chiswick.*

2312 1908. Oct. DAVIS, Cecil Wallace, P.A.S.I., 10, *Glensdale Road, Wickham Road, Brockley, S.E.*

2313 1908. Oct. FRENGLEY, Joseph Patrick, M.B., M.D., B.CH., F.R.C.S.I., D.P.H., *District Health Officer, Wellington, New Zealand.*

[illegible] 1908. Oct. *HAGUE, Harold Wilfred, *Health Inspector, Kalgoorlie, Western Australia.*

2309 1908. Oct. *HARRIS, Charles Edwin, *Glenlee, St. Mark's Road, St. Helier's, Jersey.*

2314 1908. Oct. KENNEDY, Edwin Riddell, A.R.I.B.A., *Freshford, Knock, Co. Down, Ireland.*

2315 1908. Oct. KINGSFORD, A. Beresford, M.D., M.R.C.S., L.R.C.P., D.P.H., 19, *Upper George Street, Bryanston Square, W.*

[illegible] 1898. Dec. MOLINEUX, W. F. Y., *Engineer and Surveyor's Office, Town Hall, Ulverston.*

2316 1908. Oct. MORGAN, David James, M.A., M.D., B.C.(CAMB.), D.P.H.(LOND.), F.C.S., (*M.O.H.*), *Town Hall, Swansea.*

2517 1908. Oct. MUNDELL, Joseph Edward, A.E.I.B.A., P.A.S.I., 157, *Wool Exchange, E.C.*

2518 1908. Oct. NEWCOMBE, Bertram S., *Bewsey Chambers, Warrington.*

2519 1908. Oct. OKE, Alfred William, B.A., LL.M.(CANTAB.), F.G.S., F.C.S., *Orielton*, 115, *Highfield Lane, Southampton.*

2520 1908. Oct. OWENS, John Switzer, B.A., M.D., ASSOC.M.INST.C.E., F.R.G.S., 47, *Victoria Street, Westminster, S.W.*

2521 1908. Oct. *PRITCHARD, George Herbert, "*Ty-Gwa*," 264, *Mary Vale Road, Bournville, Worcestershire.*

2522 1908. Oct. PROBYN, Major Percy John, R.A.M.C., M.B., B.S., M.R.C.S., L.R.C.P., D.P.H., *Camden House, Pontypool, Mon.*

2523 1908. Oct. PURDY, John Smith, M.D., C.M., D.P.H., F.R.G.S., *District Medical Officer, Auckland, New Zealand.*

2524 1908. Oct. RICHARDSON-JONES, William Harry, 30, *Rothesay Avenue, Nottingham.*

2525 1908. Oct. RODRIGO, Arthur Colin, *Supervisor of P.W.D. and Sanitary Works, Rangoon Municipality, Burma, India.*

2526 1908. Oct. SEWARD, Edwin, F.R.I.B.A., *Queen's Chambers, Cardiff.*

2527 1908. Oct. STEPHENS, Vincent J., A.I.E.E., *Construction Division, P.W.D.*, 57, *Thirty-sixth Street, Rangoon, Burma.*

2528 1908. Oct. STEVENSON, Thomas H. Craig, M.D., D.P.H., 24, *Severn Road, Weston-super-Mare.*

2529 1908. Oct. TOSSWILL, Leonard Robert, M.R.C.S., L.R.C.P., 34, *West Southernhay, Exeter.*

2530 1908. Oct. WARREN, William Pennefather, L.R.C.P., L.R.C.S., D.P.H., (*M.O.H.*), *Public Offices, Enfield.*

2531 1908. Oct. WILSON, Prof. William Thomas, F.R.C.V.S., *The Harper-Adams Agricultural College, Newport, Shropshire.*

2532 1908. Oct. WILLIAMS, Ralph Paul, M.D., B.S., D.P.H., (*Assist. M.O.H.*), *Town Hall, Sheffield.*

2533 1908. Oct. YEWDALL, Francis Edward, P.A.S.I., 97, *Sheen Road, Richmond, Surrey.*

ASSOCIATES.

‡ Marked thus have passed the Examination for Inspectors of Nuisances.
§ Marked thus have passed the Examination in Practical Hygiene for School Teachers.
V Marked thus have passed the Examination for Women Health Visitors and School Nurses.

Reg. No.	Date of Election.	
	1908. Oct.	‡BOON, Reginald Percy, 39, *Stone Road, Stafford.*
	1908. Oct.	*V* BRIDGE, Mrs. B. C., 36, *Cowston Street, Dunfermline, N.B.*
	1908. Oct.	‡BROCK, Ernest Robert, *Shanklin House, St. Clement's Hill, Norwich.*
	1908. Oct.	*V* BULLOUGH, Miss Gertrude, *Glen Athol, Donoughmore Road, Boscombe, Hants.*

1498 1908. Oct. ‡Davies, Thomas, 31, *Chesterfield Terrace, Lichfield.*
1499 1908. Oct. ‡Dawson, Harry, 10, *Boundary Street East, Liverpool.*
1510 1908. Oct. ‡Drake, William Ramsden, 70, *Silvermere Road, Catford.*
1511 1908. Oct. ‡Evans, Thomas Richard, 14, *Harris Street, Hirwain, near Aberdare, Glam.*
1512 1908. Oct. ‡Eversett, Willie Joseph, 230, *Corporation Road, Cardiff.*
1513 1908. Oct. ‡Flint, Gerald George, 17, *Ethel Road, Rosary Road, Norwich.*
1514 1908. Oct. ‡Gibb, Cecil Harry, 25, *Lawn Terrace, Blackheath, London, S.E.*
1515 1908. Oct. ‡Goddard, Llewellyn Beaumont, *School House, Stonegraves, Chesterfield.*
1516 1901. Feb. ‡Gough, Miss Alice, 6, *Drayton Green, West Ealing, W.*
1516 1908. Oct. § Grieve, Miss Margaret Bruce, 231, *Maryvale Road, Bournville, Birmingham.*
1517 1908. Oct. ‡Halliday, Thomas Francis, 29, *Canon Street, Barry, Glam.*
1518 1908. Oct. ‡Harper, Frank, 178, *Park Road, Northampton.*
1519 1908. Oct. ‡Henson, Frederick John, *St. Paul's Square, Tiverton.*
1520 1908. Oct. ‡Hobson, Harry, 105, *Old Street, Ashton-under-Lyne, Lancs.*
1521 1908. Oct. ‡Howells, Griffith Edward, *Llwyd Coed, Llwydarth Road, Maesteg, Glam.*
1522 1908. Oct. ‡Hutton, John, *Military Hospital, Hounslow, Middlesex.*
1523 1904. Jan. ‡Jones, George, *Upper Houghton Regis, Dunstable, Beds.*
1523 1908. Oct. ‡Jordan, Percy Albert, 20, *Hoe Street, Walthamstow.*
1524 1908. Oct. ‡King, Arthur James, 35, *High Street, Stantonbury, Bucks.*
1525 1908. Oct. ‡Lane, Albert Henry, 28, *Balfour Street, Balsall Heath, Birmingham.*
1526 1908. Oct. ‡Leach, William, 24, *Walker Street, Saw Mills, Rochdale.*
1527 1908. Oct. ‡Lewis, John Henry, *Police Station, Tonypandy, Rhondda Valley, Glam.*
1528 1908. Oct. ‡March, Miss Charlotte Augusta Leopoldine, 14, *Otterburn Terrace, Newcastle-on-Tyne.*
1529 1908. Oct. ‡Middleton, Harry, 115, *St. Mary's Road, Moston, Manchester.*
1530 1908. Oct. ‡Morgan, Edwin Rufus, *Illtyd Villa, Aberfan, Merthyr Tydvil, Glam.*
1531 1908. Oct. ‡Miller, Miss Rosa, 33, *King's Road, Canton, Cardiff.*
1532 1908. Oct. ‡Newcomen, Thomas Guy, "*Briarholme*," *Pinner Road, Harrow.*

4533 1908. Oct. ‡Nicholson, Dillwyn Croft, 15, *Northgate Terrace, Cardigan.*

4534 1908. Oct. ‡Phillips, David John, *Glanyrafon House, Cwmtwrch, R.S.O., Glam.*

4535 1908. Oct. ‡Price, Frederick George, 2, *Fir Fields, Doxey, Stafford.*

4536 1908. Oct. ‡Robinson, Alexander Llewellyn, *Tamworth-in-Arden, Warwick.*

4537 1908. Oct. ‡Smith, Walter, 24, *Kensington Park Road, Brislington, Bristol.*

4538 1905. Dec. ‡Stazicker, Henry, *Willow Cottage, Croston, near Preston.*

4539 1908. Oct. ‡Virtue, Miss Isabel, 93, Palmer Street, Blackburn.

4540 1908. Oct. *s* Wedd, William Frederick, 39, *Corn-mill Lane, Tutbury, Burton-on-Trent.*

4541 1908. Oct. ‡White, Sidney Tom Wright, 19, *Cape Road, Warwick.*

4542 1908. Oct. *s* Wilson, Miss Lucy Mary, *Otterburn, The Avenue, Hitchin.*

4543 1908. Oct. ‡Williams, Sergt. Henry, *R.A.M. Corps, Military Hospital, Lancaster.*

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*** *For Publications of Societies and Institutions, etc., see under "Academies."*

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* Members or Associates wishing to file or catalogue these Titles can, on application, be supplied with excerpt copies for this purpose.

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——— Dr. L. W. Darra Mair's Report to the Local Government Board upon the Sanitary Circumstances and Administration of the Dartford Rural District. 11 pp., fcap. London, 1908.

——— Dr. H. Timbrell Bulstrode's Report to the Local Government Board upon the Sanitary Condition of the Dunmow Rural District and upon the Administration of the Rural District Council. 10 pp., fcap. London, 1908.

——— Dr. S. W. Wheaton's Report to the Local Government Board on a Re-inspection of the Pewsey Rural District Council, and on Sanitary Administration by the Rural District Council. 12 pp., fcap. London, 1908.

——— Dr. H. Timbrell Bulstrode's Report to the Local Government Board upon the Sanitary Circumstances of the Halstead Urban District, in the County of Essex, and upon the Sanitary Administration of the District Council. 10 pp., fcap. London, 1908. *A. Newsholme, M.D., F.R.C.P.*

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DRAINAGE BY-LAWS OF THE LONDON COUNTY COUNCIL

Under the Metropolis Management Act, 1855, section 202.

At the Sessional Meetings held in May and October, 1907, a number of suggestions were put forward for amending the Drainage By-Laws of the London County Council (see Journal, Vol. XXVIII., pp. 225–250, 439–449). The Council of the Institute appointed a Special Committee to consider the points raised and arrange and tabulate the alterations necessary, and, as a result of their report to the Council, the following amendments and additions were sent to the London County Council:—

Amendments Suggested by the Council of the Institute.

By-law 1. At the end of the first paragraph add the following: –

"In any case in which from any cause sewage may flow back or be forced into a subsoil drain he shall provide near the outlet of such trap an apparatus which will automatically prevent the access of sewage thereto."

By-law 3. At the end of the first paragraph add the following:—

"Provided that any person who shall construct or reconstruct any pipe for the purpose of conveying to any sewer any water that may fall on the roof, so far as he shall effect such works in any building erected before the confirmation of these by-laws, in which, in the opinion of the Sanitary Authority, it shall be impracticable to cause such pipe to discharge in the open air, shall be deemed to have complied with this by-law if he construct such pipe, as to sectional area and materials, in accordance with the requirements in these by-laws applicable to a soil-pipe in a similar position, and cause such pipe to discharge into a properly-trapped gully above the level of the water in the trap thereof."

By-law 3. In the second paragraph, third line, before the words "or lavatory" insert "bath."

By-law 4. First paragraph, third line, omit the words "communicating with a sewer."

By-law 8 (i) (a). First paragraph, second line, after the words "such opening" add a comma and the words "and in such a position as to admit of the safe discharge of the foul air when acting as an outlet."

(b) Third paragraph, fourth line, after the words "such opening" add the words "and in such a position as to admit of a safe discharge of foul air when acting as an outlet."

(iv) After the words "four inches" in third line, insert the words "if the drains exceed six inches in diameter, and of not less than three and a half inches if the drains do not exceed six inches in diameter."

Between (v) and (vi) insert the following new section:

"He shall construct every pipe used in connection with any of the arrangements hereinbefore specified so that it shall not be connected with

any rainwater pipe or with the waste of any lavatory or bath, or of any sink other than one which may be provided for the reception of urine or other excremental filth."

(vi) Second paragraph, sixth line, strike out the word "four" and substitute "six."

By-law 9. At the end of the by-law add the following:

"Provided that any person who shall construct or reconstruct any pipe or drain or other means of communicating with a sewer, or any trap or apparatus in connection therewith, so far as he shall effect any such works in any building erected before the confirmation of these by-laws, in which in the opinion of the Sanitary Authority it shall be impracticable to avoid the preceding prohibition, shall be deemed to have complied with this by-law if he construct any properly trapped inlet to such drain, except such inlet as may be necessary from the apparatus of any water-closet, slop-sink, or urinal, with an air-tight cover, and efficiently ventilate the seal of the trap by a pipe leading to the outer air."

By-law 10. In the first paragraph, second line, and the second paragraph, first line, before the words "or sink" insert "bath." In the first paragraph, fourth line, before the word "iron," put a comma and insert the words "brass, copper, gun-metal."

By-law 10. After third paragraph add the following;—

"A person who shall erect a new building designed to be let in flats or tenements, shall cause the waste-pipes of kitchen or scullery sinks on all floors of such building above the lowest to discharge into a pipe external to the building; such pipe to be carried down to discharge into a gulley on the ground level, and to be carried up full bore to above the roof for ventilation. He shall not construct such waste-pipes as to cause them to discharge into open hopper heads; and he shall cause the joints of all the pipes to be securely made so as to be air-tight. He shall ventilate the branch waste-pipes by anti-siphonage pipes, which shall be carried up full bore to a point above, and not in the neighbourhood of, any windows of such building.

A person who shall erect a new building designed to be let in flats or tenements, shall cause the waste-pipes of all baths and lavatory basins on all floors of such building above the lowest, to discharge into a pipe external to the building, such pipe to be carried down to discharge into a gulley on the ground level, and to be carried up full bore to above the roof for ventilation. He shall not construct such waste-pipes as to cause them to discharge into open hopper heads; and he shall cause the joints of all the pipes to be securely made so as to be air-tight.

If he causes the waste-pipes of baths and lavatory basins to discharge into the same pipe which receives the discharges of kitchen or scullery sinks, he shall ventilate the branch waste-pipes of such baths and lavatory basins by anti-siphonage pipes, to be carried full bore to a point above, and not in the neighbourhood of, any windows in such building.

For the purposes of this by-law it shall be lawful to connect together in one pipe the anti-siphonage pipes of any baths, lavatory basins, kitchen or scullery sinks, provided that such pipe is carried up full bore above any windows of such building as hereinbefore provided."

By-law 11. First paragraph, after the last word put a semicolon and add the following words:—

"Provided also that he may construct such soil-pipe in heavy cast iron, and so as to be easily accessible, if, having regard to the circumstances of the case, the Sanitary Authority shall consider that a soil-pipe of such material would be more suitable, and shall consent in writing to the construction of such pipe in heavy cast iron."

Paragraph 4, second line, after the words "any bath" insert "or lavatory."

By-law 18. Paragraph 2, in the fifth line, delete all after the words "than three inches," and substitute the following:—

"Or two inches in the case of a urinal having not more than two basins or compartments, and he shall construct such pipe so that its weight, if the pipe be of lead, and its thickness and weight, if the pipe be of iron, in proportion to its length and internal diameter, shall be—

Diameter.	Lead. Weight per 10 feet length, not less than	Iron. Thickness of metal, not less than	Iron. Weight per 6 feet length (including socket and beaded spigot or flanges, the socket not to be less than $\frac{1}{4}$-in. thick) not less than
2 inches	42 lbs.	$\frac{3}{16}$ inch	26 lbs.
$2\frac{1}{2}$ „	50 „	$\frac{3}{16}$ „	31 „
3 „	60 „	$\frac{3}{16}$ „	37 „

Notes for additional Drainage By-Laws dealing with Urinals.

Approach.—Not directly from any scullery, wash-house, billiard room, or any room used for the purpose of human habitation, or for the manufacture, preparation, or storage of food for man, or as a factory, workshop, or workplace.

Every passage, lobby, landing, area, or other approach to a urinal to be of such size, and to be lighted and ventilated by a window, skylight or other means of communication with the open air, as shall be approved by the Sanitary Authority of the district.

Walls, window, ventilation, door, open space.—Same as for w.c.'s, with the additional provision that the interior surfaces of walls are to be formed of or covered with hard impervious material. No opening for ventilation to be made into any scullery, wash-house, etc.

Ceiling.—To be formed of hard impervious material.

Floor.—To be formed of hard impervious material made to fall to a channel under the basins, or in or near the stalls; channel to fall to a trapped gully communicating with drain.

In cases where urinal basins or stalls are fixed in a lavatory or bath-room, the floor for a width of not less than three feet from the wall against which the basins or stalls abut, and for a length of not less than two feet on each side of the middle of each basin or stall, to be paved and provided with channel and gully as above mentioned.

Urinal basins or stalls.—Urinal basins or receptacles to be formed of semi-vitrified ware, glazed, or of some equally suitable material, with trapped outlet which must be accessible for purposes of examination and cleansing.

Urinal stalls to be formed of similar material, and the floor of such stall to be so formed as to fall towards a channel placed as near as practicable to the stall, or towards an outlet discharging into such channel or into a trapped gully as near to the stall as practicable. The channel to be formed of semi-vitrified ware, glazed, laid with a fall of not less than 1 in 30, and made to discharge into a trapped gully.

The pipes used to convey the discharge from urinals to be as follows:—From the trapped outlet of a basin or receptacle to a drain, to a branch, or to a main waste pipe, of glazed stoneware, cast-iron, or drawn lead, of an internal diameter of not less than two inches.

From a gully used in connection with a channel or stall to a drain, if the pipe be underground, of glazed stoneware or cast-iron; if the pipe be above ground, of cast-iron or drawn lead; in either case the internal diameter of the pipe to be not less than three inches, paragraph 3 of By-Law 4 (Drainage By-Laws) notwithstanding.

From a gully used as above mentioned to a branch or to a main waste pipe, of cast-iron or drawn lead, of an internal diameter of not less than three inches.

The provisions of By-Law 4 (Drainage By-Laws) to apply to all underground pipes, and the provisions of By-Laws 15 and 16 to apply to the connection of cast-iron pipes with stoneware pipes or gullies, and *vice versâ*.

The provisions of By-Laws 11, 12, 13, 14, 15, 16, 17, to apply as far as practicable to pipes which are above ground. 2 in. and 3 in. lead pipes to be not less than the thickness of 8 lbs. lead. Cast-iron pipes to be not less than $\frac{3}{16}$ in. thick.

Flushing.—Similar provisions to those in By-Law 3 (Water-closets, etc.) should be made, as far as practicable with respect to the flushing of urinals. Not less than one gallon of water to be applied to each basin, receptacle, or stall, each time of flushing, except in the case of urinals flushed by a continuous flow of water. The flushing pipe and its connection to a basin, receptacle, or stall, to be not less than $\frac{1}{2}$ in. internal diameter.

By-Laws made by the London County Council under the Metropolis Management Act, 1855, Section 202, and the Metropolis Management Acts Amendment (By-Laws) Act, 1899.

Additional By-Laws suggested by the Council of the Institute.

(*a*) Every person who shall deposit with a Sanitary Authority the plans, sections, and particulars mentioned in By-Laws 1 and 2 of the By-Laws made by the London County Council under the Metropolis Management Act, 1855, sec. 202, and the Metropolis Management Acts Amendment (By-Laws) Act, 1899, shall, at the time of making such deposit, furnish to such authority a statement of the time when the work referred to in such plans, sections, and particulars, will be commenced and completed, and shall complete such work not

later than the time mentioned in such statement. Provided that the Sanitary Authority may require the work to be completed before the date mentioned in such statement, or may sanction such an extension of time for the completion of the work as may seem to them reasonably necessary.

(*b*) Every person who shall carry out any work mentioned in the by-laws made by the London County Council under the Metropolis Management Act, 1855, sec. 202 (Drainage By-Laws), or the by-laws made under the Public Health (London) Act, 1891, sec. 31 (i), shall, two days before proceeding to cover up or to enclose any such work, and within four days after the completion of the fixing of any work which is not intended to be covered up or enclosed, give to the Sanitary Authority of the district notice in writing of his intention to cover up or enclose, or of the completion of the fixing of such work, in order that the same may be inspected and tested by an officer of such authority.

(*c*) In default of such notice, or, if on inspecting any such work as aforesaid, within the period specified in the preceding by-law, an officer of the Sanitary Authority of the district shall find that such work is so far advanced that he cannot ascertain whether the requirements of any by-law relating thereto have been complied with, the person who shall have carried out such work shall, within forty-eight hours from the delivery at his address of a notice in writing signed by an officer of such authority, cause so much of the work as such officer shall require, to be cut into, laid open, uncovered, or pulled down, to enable the officer to ascertain whether the requirements of any such by-law have been complied with.

(*d*) When it is found by an officer of the Sanitary Authority of the district that any work to which the by-laws mentioned above apply has not been carried out in accordance with such by-laws, the person who should have carried out such work, or the owner of the premises on which the same shall be found, shall, within such reasonable time as shall be specified in a notice in writing so to do, signed by an officer of such authority and delivered at the address of such person or owner, cause anything done contrary to any such by-law to be amended, or anything to be done which by any such by-law may be required to be done, but which has been omitted.

Upon the completion of the work specified in such notice, such person or owner shall give the notice required by the above by-law (*b*) before such work is covered up or enclosed, and shall afford the officer of the Sanitary Authority free access to such work for the purpose of inspection and testing.

(*e*) No work to which the above by-laws apply, and which has or shall have been carried out, made, or provided in accordance with such by-laws, shall be altered in such manner that if it had been so carried out, made, or provided originally it would not have been in conformity with the by-laws relating thereto; nor shall anything be done which would have such an effect on the work that if such work had been so carried out, made, or provided originally, it would not have been in conformity with the by-laws relating thereto. Any person who shall do or cause to be done any act contrary to this by-law shall be deemed to be a person who has offended against the by-law.

THE ROYAL SANITARY INSTITUTE.

REVIEWS OF BOOKS.

School Hygiene and the Laws of Health.*

The first edition of this work was favourably reviewed in the issue of the Journal for February, 1907. The circumstance that a second edition is called for within two years is testimony to the fact that the first edition met with the success which was predicted for it; and the circumstance has afforded an early opportunity of extending certain chapters in several important respects, and of adding a chapter upon the medical inspection of schools and school children. Some of the new matter has been added in the form of appendices. Doubtless the subject-matter of these appendices will be let into the appropriate chapters in the next edition; for the present arrangement is disconnected and inconvenient.

H. R. K.

Ventilation of Public Sewers.†

The author in not too large a volume, and in a very readable way, treats of a subject which has always been, and still is, a burning question. He first clears his ground by emphasising very necessarily the difference between sewer air and sewer gases, in other words, to odours due to foul-smelling liquid and those generated by decomposition of sewage. He states that while no definitely reliable conclusions have yet been arrived at as to whether or not diseases are really spread by emanations of foul air from sewers, authorities generally are agreed that there is danger to health from poisonous emanations and that sewers should be ventilated. Chapters III. to VI. are devoted to the consideration of the various means which are adopted for purifying sewers by natural and artificial air currents, and by deodorisation, also the cost of various systems. Illustrative sketches are introduced, and views of various recognised authorities are cited. Attention should especially be drawn to the admirable summary which constitutes Chapter VII.; the second paragraph stating that each system of sewers must be considered and dealt with on its own basis, and giving the reason why, is one with which everyone acquainted with the subject must agree; nor is it likely that exception will be taken to the other conclusions arrived at. The Appendix occupies 83 pages, consisting of extracts from Reports of leading authorities, papers read and discussions thereon at the meetings of The Royal Sanitary Institute, the Association of Municipal and County Engineers, etc., all of which are full of interest bearing on the subject. The author must surely be congratulated on the production of a most opportune and useful book. W.C.T.

Municipal Lessons from Southern Germany.‡

This book is a graphic and interesting account of a visit paid in 1907 to Germany by the Committee of the British Municipal Society for promoting the study of Foreign and Colonial Institutions, of which Dr. Lunn is the Honorary Secretary.

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* The Ventilation of Public Sewers, by John S. Brodie, M.Inst.C.E. 170 pp. London, 1908. The St. Bride's Press, Ltd.

† School Hygiene and the Laws of Health, by Charles Porter, M.B., B.Sc., M.R.C.P.E. Second Edition. Longmans, Green, and Co. London, 1908. Pp. 335. 7s. 6d. net.

‡ Municipal Lessons from Southern Germany, by Henry S. Lunn, M.D., J.P. 139 pp., 8vo. London, 1908. T. Fisher Unwin.

The Right Hon. Sir John Gorst writes an excellent introduction, in which he points out that municipal affairs in Germany are governed and managed by experts and not amateurs, as the calling of a burgomaster is a skilled profession, to which a lifetime has to be devoted. The elected councillor or alderman, with absolutely no expert training, as known in this country, is unheard of in Germany.

The body of the book is a description of the committee's tour, and gives some most valuable and interesting descriptions of municipal government in Germany.

The local taxation is very different from ours, as there is an income tax and a fortune tax, and a tax on land whether built on or not, a tax on business, and a special tax on "stores" dealing in more than one class of goods. It would be interesting to know how much this tax would realise from some of the great "stores" in London alone.

There are many other minor taxes, including one on dogs at Cologne, where there is a tax of 16 marks for each dog. "but if a citizen has an additional dog it is considered a still greater luxury, and he has to pay 24 marks for it." This is a good measure, and it is to be regretted that in towns in England we have not a similar tax, as dogs are unquestionably a nuisance in all towns, and are not in the least required.

There is a chapter on the educational system of Frankfort, which has practically no state aid. It appears to work admirably, and it is stated, "a strictly centralised educational system that takes no account of local conditions must be less efficient than one which has grown up to meet requirements which were actually felt." This statement might be a lesson to us, who are so frequently using the education question for political purposes.

There is also an excellent chapter on town extension in Frankfort, which the legislature of this country might study with advantage in drafting the Town Planning Bill now before Parliament.

There are chapters on the streets and roads of Frankfort, street cleansing, and the sewerage of Frankfort, which are exceeding useful, though we have not much to learn on these subjects from the practice of foreign towns.

The book is a useful contribution to the literature on municipal practice in "foreign parts," and is exceedingly well printed and edited. The price is not stated, which is to be regretted. H. P. B.

Cast-iron House Drainage.*

The author is a keen advocate of iron drains, and doubtless with good reason. He does not pretend that the principles involved in connection with iron drainage differ from those of stoneware systems, but having made out a good case for the use of iron, he explains very fully its application in detail, accompanying his remarks with many and good illustrations. Further on he deals with the principles of house drainage generally, and treats of the apparatus in connection therewith. A close study of the book shows that the author is very fully acquainted with his subject, both in practice as well as theory, drawing attention to all those little niceties, the full appreciation of which alone can guarantee perfection. The illustrations have the merit that they are typical, and not merely representations of specific goods of certain manufacturers, as is so

* "Cast iron House Drainage," by Gerard J. G. Jensen, C.E. 200 pp., 8vo. London, 1908. Sanitary Publishing Co.

often the case in works of this kind. Altogether the work is a somewhat refreshing departure from the well-worn track of "house drainage," and is quite one of the best and most up-to-date guides on the subject. W. C. T.

The Law of Hospitals.*

This is a useful compendium of statute and judge-made law relating to hospitals for the reception of surgical and medical cases, and is likely to afford valuable legal "first aid" to hospital secretaries and managers.

Among the subjects dealt with are hospital accounts, provision of ambulances by local authorities, death in hospital, insurance, special hospitals, and claims for negligence.

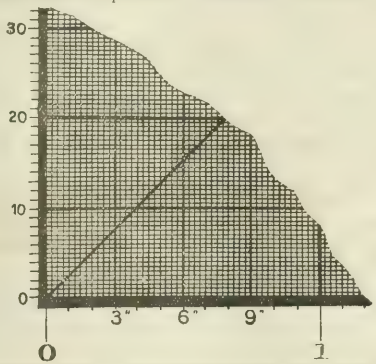
Though the book deals with a variety of subjects, the information given is not only intelligible to the lay mind, but is as full as is necessary in a text-book of this character.

We note on page 86 that the author is in doubt as to whether a hospital for the accommodation of other than infectious patients can be built under section 131 of the Public Health Act. As a matter of fact, at least one authority (Barry Urban District Council) has already provided a general hospital by virtue of the powers conferred by this section. H. M. R.

The Abbott Versimetric Chart.†

A series of simple Charts for converting our British weights and measures into their metrical equivalents, and *vice versâ*, has now been devised by Mr. Thomas W. Abbott, and may be found useful to teachers for converting anthropometric measurements made in connection with medical inspection of scholars.

The Chart is a square, divided by vertical lines representing British weights and measures, noted at top and bottom, while horizontal lines give the divisions of an equal amount on both sides in metric notation. A diagonal line between opposite corners indicates the points of coincidence of the two scales.



* The Law of Hospitals, Infirmaries, Dispensaries, and other kindred institutions, whether voluntary or rate-supported, by Arthur Turnour Murray, B.A. Pp. 287 + xvii. London, 1908. John Murray. 10s. 6d.

† The Abbott Versimetric Chart. Published by A. Couchman, Watergate House, York Buildings, Adelphi, W.C. Price 1s.

ARTICLES RELATING TO PUBLIC HEALTH,*

Appearing in the chief British and Foreign Journals and Transactions.

The articles referred to in this list are as far as possible collected and filed in the Library of the Institute for the use of the Members and Associates.

Water Supply, Sewerage, and Refuse Disposal.

JOHNSTON, J. H., M.Sc. The Role of Colloids in the Purification of Sewage. *Surveyor*, May 1st, 1908, p. 520.

Character of organic matter in sewage—investigation.

WATTS, WM., M.Inst.C.E., F.G.S. The design and construction of Impounding Reservoirs. *Surveyor*, July 3rd, 1908, pp. 11 and 12.

Embankment—trench excavation and formation of earth embankment—comparison of water supplies in various towns—general considerations.

WILLIAMSON, ANDREW, Assoc.M.Inst.C.E. The Bamford Filters of the Derwent Valley Water Board. *Engineering*, July 24th, 1908, pp. 100–01.

Description (illustrated) of the filters—roughing filters—sand filters—gauge well—pressure tank.

"THE ENGINEERING RECORD." The Disposal of the Waste Products of Gas Works. Oct. 17th, 1908, p. 434.

Description of the usual waste products, and their effect when discharged into drains and streams—modes of purification.

——— The New Refuse Destructor at West New Brighton, N.Y. Oct. 3rd, 1908, p. 386.

Particulars of a Destructor based upon the Heenan and Froude type, and designed after visiting forty installations in Great Britain.

——— The Relative Action of Sand, Contact, and Sprinkling Filters on Organic Matter. Oct. 24th, 1908, p. 457.

Review of H. W. Clark's experiments in Massachusetts' Board of Health Experiment Station.

Personal and Domestic Hygiene.

KAYSER, DR. PAUL. Gymnastic exercises and games in higher and lower schools from a hygienic point of view. *Deutsche Vierteljahrsschrift für öffentliche Gesundheitspflege*, vol. 40, part 4, p. 595.

This is an interesting paper on the value of gymnastic exercises and games during school life. The author examines the whole question very carefully and mentions what has been done in Germany in this respect by the various Governments. "We ought not to educate one mind and one body, but the human being as a whole, and must not divide it."

* Members or Associates wishing to file or catalogue these Titles can, on application, be supplied with excerpt copies for this purpose.

MEETINGS HELD.

Durham.—The meeting was held in the Shire Hall on Saturday, November 14th, when a discussion on "The Health Visitor and School Nurse in relation to Sanitary Administration" was opened by Dr. H. Renney, M.O.H., Sunderland. The chair was taken by Col. J. Lane Notter, M.A., M.D., Deputy-Chairman of Council. The Mayor (Councillor Boyd) welcomed the members. Visits were made to the Cathedral and Castle, by the courtesy of the Dean (the Very Rev. G. W. Kitchin, D.D.) and the Principal (Dr. Gee), who very kindly conducted the members over the buildings.

Lecture to the Institute.

A Lecture on "The Results of Sanitation in the Efficiency of Armies in Peace and War" was delivered in the Parkes Museum on Wednesday, November 18th, by Surgeon-General Sir Alfred Keogh, K.C.B. The Charts and Diagrams illustrating the lecture were explained by Lieut-Col. C. H. Melville. In the absence of the President the chair was taken by Col. J. Lane Notter, M.A., M.D., Deputy-Chairman of Council.

Examinations.

The following Examinations were held:—

Sanitary Science as applied to Buildings and Public Works.

Liverpool, Oct. 30th and 31st.	2 Candidates; no Certificate granted.
Bristol, Nov. 6th and 7th.	2 Candidates; 1 Certificate granted.
Newcastle, Nov. 20th and 21st.	2 Candidates; no Certificate granted.

Women Health Visitors and School Nurses.

Liverpool, Oct. 30th and 31st.	4 Candidates; 3 Certificates granted.
Newcastle, Nov. 20th and 21st.	2 Candidates; 1 Certificate granted.

Inspectors of Nuisances.

Liverpool, Oct. 30th and 31st.	27 Candidates; 13 Certificates granted.
Bristol, Nov. 6th and 7th.	23 Candidates; 11 Certificates granted.
Newcastle, Nov. 20th and 21st.	39 Candidates; 17 Certificates granted.

Inspectors of Meat and Other Foods.

Sheffield, Nov. 13th and 14th.	11 Candidates; 4 Certificates granted.

Candidates who have received Certificates.

Sanitary Science as applied to Buildings and Public Works.

Gray, Frederick Rowland.

Women Health Visitors and School Nurses.

Cowen, Emily Mary.
Davies, Katie.
Ebbetts, Dorothy C.
Powell, Mary Maddock.

Inspectors of Nuisances.

Ashcroft Marion.
Bagnall Elizabeth.
Brittain, Ernest.
Brown, Henry.
Butterworth, Charles Ernest.
Clark, Robert Boston.
Clift, Rosa Gweneth.
Coles, Albert.
Compton, Harold Arthur.
Cruttenden, Arthur Bertie.
Dodd, Thomas William.
Dodsworth, John.
Edgar, David Campbell.
Elliott, Thomas.
Folland, Gordon Radmore.
Hancock, Clarence Coles.
Harris, Francis John.
Irving, William.
Isherwood, Arthur.
Jones, John.
Knee, William Henry.
Lotinga, Alfred Giller.
McQueen, William Leithrow.
Morrish, William James Marmaduke.
Perkins, William Edward.
Phillips, Arthur S.
Pickering, Herbert.
Powell, William J.
Raine, Harry Eubank.
Ridley, James Robson.
Ridley, William.
Robson, John Temple.
Russell, David.
Watson, Arthur.
Wearing, Bertha Elizabeth.
Whalley, George.
Whitford, Edwin Thomas St. Ledger.
Willder, Gladys May.
Williams, Daniel.
Willis, Elizabeth.
Wilson, Robert Edmanson.

Inspectors of Meat and Other Foods.

Bamforth, Frank.
Green, Albert.
Ross, William Lecky.
Sagar, Joseph.

FORTHCOMING MEETINGS

Sessional Meetings.

Manchester.—Arrangements have been made for a Sessional Meeting to be held in January next. The authorities of the Royal Infirmary have kindly given permission for a visit to the New Buildings, of which Mr. Edwin T. Hall, V-P.R.I.B.A., and Mr. John Brooke, F.R.I.B.A., are the architects. This visit will be followed by a meeting at the School of Technology, when the Council have asked Mr. Hall to give a general description of the Buildings, and a general discussion will follow.

It is proposed to make the visit on a Friday afternoon at 2.30 p.m., and to hold the meeting in the evening at 7 p.m. The actual date will be announced in the next Journal.

Examinations.

In Sanitary Science as applied to Buildings and Public Works, for Inspectors Qualifying for Membership, for Inspectors of Nuisances, in Hygiene in its Bearing on School Life, and for Women Health Visitors and School Nurses—

Manchester, December 11th and 12th.

Inspectors of Meat and Other Foods—

London, December 18th and 19th.

Calendar for December, 1908, and January, 1909.

As far as at present arranged.

DECEMBER.

1 Tu. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., at the Parkes Museum, by James King, M.R.C.V.S.

3 Th. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Fish, Eggs, Tea, Coffee, Cocoa and Chocolate, Lime Juice, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

4 F. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Wheat, Rice, Arrowroot, and other Grains, Potatoes, Flour, Bread, Biscuits, Sugars, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

4 F. Lecture—Meat Inspectors' Course, at 6.30 p.m.

5 S. Demonstration to Commissioned Officers and Professional Men at 11 a.m. at the Metropolitan Cattle Market, by James King, M.R.C.V.S.

7 M. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Succulent Vegetables and Fruits, Jams; the Condiments—Vinegar, Pepper, Mustard; Prepared, Concentrated, and Preserved Foods, by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

8 Tu. Lecture to Commissioned Officers and Professional Men, at 5.30 p.m., at the Parkes Museum, by James King, M.R.C.V.S.

10 Th. Demonstration to Commissioned Officers and Professional Men at a Factory for Preparation of Concentrated and Preserved Foods.

10 Th. Lecture to Commissioned Officers and Professional Men, at 5 p.m. Alcoholic Beverages—Beer, Wines, Whisky, Brandy, etc., by Col. J. Lane Notter, M.A., M.D., D.P.H., R.A.M.C.

11 F. } Examinations—Manchester.
12 S. }

12 S. Demonstration—Meat Inspectors' Course, at 2 p.m.

18 F. } Examination for Inspectors of Meat and other Foods, London.
19 S. }

25 F. } **Christmas Day** } Museum and Library closed.
26 S. } **Boxing Day** }

JANUARY.

Sessional Meeting, Manchester. Visit to the new Royal Infirmary, followed by a discussion on a general description of the buildings by Edwin T. Hall, V-P.R.I.B.A.

29 F. } Examinations—Plymouth.
30 S. }

LIST OF FELLOWS, MEMBERS, AND ASSOCIATES ELECTED,

November, 1908.

FELLOWS.

† Marked thus have passed the Examination of the Institute for Local Surveyors.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.

Reg. No.	Date of Election.	
1716	1908. Nov.	Armstrong, William George, M.B., M.S.SYDNEY, D.P.H.CAMB., *City Town Hall, Sydney, New South Wales.*

1074 1908. Nov. FOWLER, Gilbert John, D.SC., F.I.C., *Broad Oak, Urmston, near Manchester.*

1521 1908. Nov. GLEN, Alexander, M.A., LL.M., K.C., *New Court, Temple, E.C.*

1132 1908. Nov. HEMBROUGH, John William, M.D., L.S.SC., M.R.C.S., D.P.H., *The Moot Hall, Newcastle-upon-Tyne.*

533 1908. Nov. †‡SMITH, Charles Chambers, *Public Hall, Sutton, Surrey.*

1267 1908. Nov. WILSON, H. McLean, M.D., B.SC. (PUBLIC HEALTH), C.M., *Blenheim Road, Wakefield.*

MEMBERS.

: Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.
* Marked thus have passed the Examination of the Institute in Sanitary Science as applied to Buildings and Public Works
S Marked thus have passed the Examination of the Institute in Hygiene in its bearing on School Life.
M Marked thus have passed the Examination of the Institute for Inspectors of Meat and Other Foods.

Reg. No	Date of Election.	
2530	1908. Nov.	‡ *S* ADAMS, H. J., 26, *Wakehurst Road, Wandsworth Common, S.W.*
2540	1908. Nov.	*BOYD, Samuel Robert, *Public Works Department, Hong Kong, China.*
2541	1908. Nov.	BROWN, John Percival, M.B., CH.B., *Burwood House, Bacup, Lancs.*
2542	1908. Nov.	CORADINE, William Alexander, STUD.INST.C.E., *Surveyor's Department, Town Hall, Bethnal Green, N.E.*
2543	1908. Nov.	*M* CUMPSTON, John Howard Lidgett, M.D., B.S., D.P.H., *(M.O.H.), Central Board of Health, Perth, Western Australia.*
2544	1908. Nov.	FEATHER, Frederick, 3, *Mount Pleasant, Chepstow, Monmouth.*
2545	1908. Nov.	FEGEN, Charles Milton, M.R.C.S., L.R.C.P., D.P.H., *(M.O.H.), R.D.C., Town Hall, Croydon.*
2546	1908. Nov.	GRIFFIN, Innes, M.R.C.S., L.S.A. *(M.O.H.), Town Hall, Banbury, Oxon.*
2547	1908. Nov.	JONES, John Arnallt, M.D., D.P.H., M.R.C.S., L.R.C.P., L.S.A., J.P. *(M.O.H.), Heathmont, Aberavon, Port Talbot, Glam.*
2548	1908. Nov.	KNIGHT, John, M.D., D.P.H. *(M.O.H.)*, 9, *Trinity Road, Scarborough.*
2549	1908. Nov.	‡MUNRO, Andrew John, *Claremont Villa, Baker Street, Enfield.*
2550	1908. Nov.	MUSSEN, A. A., M.D., D.P.H., *Public Health Department, Municipal Buildings, Liverpool.*
2551	1908. Nov.	PEARCE, George Harper, D.P.H.CAMB., L.R.C.P., L.R.C.S.E., *Darton Hall, Darton, near Barnsley.*

2532 1908. Nov. ROCK, Frank Ernest, M.D., M.R.C.S., L.R.C.P., D.P.H., *Uppfield, Bush Hill Road, Winchmore Hill, N.*

2533 1908. Nov. STRATON, Capt. Charles Henry, R.A.M.C., M.R.C.S., L.R.C.P., *Royal Army Medical College, Millbank, S.W.*

2534 1908. Nov. THOMAS, Richard David, L.R.C.P., L.R.C.S., L.M. (*M.O.H.*), *Severn Street, Welshpool.*

2535 1908. Nov. *SIDLE, Randolph Sefton, 3, *Parliament Square, Edinburgh.*

ASSOCIATES.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.
√ Marked thus have passed the Examination of the Institute for Women Health Visitors and School Nurses.

Reg. No. Date of Election.

4546 1908. Nov. ‡COBBETT, Frederick George, *Town Hall, Banbury.*

4547 1908. Nov. ‡DOBSON, George, 11, *Ashby Road, Loughborough.*

4548 1908. Nov. √GORDON, Miss Annie Macarthur, 26, *Dalfield Terrace, Dundee.*

4549 1908. Nov. ‡OWEN, John, 9, *Newton Street, Abercanaid, Merthyr Tydfil.*

4550 1908. Nov. ‡PEARSON, George Parker, *Blaby, Leicestershire.*

4551 1908. Nov. ‡RICHARDSON, Miss Eleanor, *Aslockton, Nottingham.*

4552 1908. Nov. ‡SPENCE, Norman Findley, *The Parks, Loughborough.*

4553 1908. Nov. √THOMPSON, Miss Georgina Sarah Jane, *Awe Fields Farm, Londonderry Road, Smethwick, Worcester.*

4554 1908. Nov. ‡WATT, Alexander, 189, *Dalkeith Road, Edinburgh.*

4555 1908. Nov. ‡WILKINSON, Miss Mary Sabina, 6, *Wetherby Terrace, Earls Court Road, S.W.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY.

*** *For Publications of Societies and Institutions, etc., see under "Academies."*

ACADEMIES (BRITISH).

City of London College. Calendar, 1908–1909. 191 pp., 8vo. London, 1908. *The College.*

Municipal and County Engineers. Proceedings of the Incorporated Association of. 308 pp., 8vo. London, 1908. *The Association.*

University of London. *University College.* Session MDCCCVIII.–MDCCCIX. 478 pp., 8vo. London, 1908. *The College.*

Royal College of Surgeons of England. Calendar, 1908. 371 pp., 8vo. London, 1908. *The College.*

Royal Institute of British Architects. Calendar, 1908 9. 448 pp., 8vo. London, 1908. *The Institute.*

The Institution of Civil Engineers. Minutes of Proceedings, Vol. CLXXII. 407 pp., 8vo. London, 1908. *The Institution.*

ACADEMIES (AMERICAN).

Henry Phipps Institute. Fourth Annual Report. 430 pp., 8vo. Philadelphia, 1908. *The Institute.*

Bombay Improvement Trust. Administration Report for the year ending 31st March, 1908. 20 pp., fcap. Bombay, 1908. *W. H. Shilstone, Secretary.*

Chalmers, *A. K., M.D.* The Growth of Cities in relation to Town Planning. 27 pp., 8vo. London, 1908. *The Author.*

Collingridge, *W., M.D., D.P.H.* Report of the Medical Officer of Health for the City of London on Soda-water. 11 pp., fcap. London, 1908. *The Author.*

Dunbar, *Prof. Dr.* Principles of Sewage Treatment. Translated, with the author's sanction, by H. T. Calvert, M.Sc., Ph.D., F.I.C. 271 pp., 8vo. London. *Charles Griffin & Co., Ltd. (publishers).*

Eager, *Assistant Surg.-General, J. M.* The present Pandemic of Plague. 30 pp., 8vo. Washington, 1908. *The Author.*

Freeman, *A. C., M.S.A.* The Architect's Directory, 1908. *The Author.*

Jackson, *Major, R. W. H.* A Trip to India during the Plague Season. 12 pp., 8vo. Jamaica, 1908. *The Author.*

Local Government Board. Thirty-Sixth Annual Report, 1906–7. 321 pp., 8vo. London, 1908.

——— Dr. Reginald Farrar's Report to the Local Government Board on the Sanitary Circumstances and Administration of the Southwell Rural Districts, Notts. 17 pp., fcap. London.

——— Dr. F. St. George Mivart's Report to the Local Government Board on the General Sanitary Circumstances and Administration of the Westhampnett Rural District. 10 pp., fcap. London, 1908.

——— Dr. J. Spencer Low's Report to the Local Government Board upon the Sanitary Circumstances and Administration of the Heckmondwike Urban District. 17 pp., fcap. London, 1908. *A. Newsholme, M.D., F.R.C.P.*

Lunn, *H. S., M.D.* Municipal Lessons from Southern Germany. 137 pp., 8vo. London, 1908. *The Author.*

Lyster, *R. A., M.D., Ch.B., B.Sc.* School Hygiene. 388 pp., 8vo. London. 1908. *University Tutorial Press, Ltd.*

Martin, *George H.* School Hygiene in Massachusetts. 46 pp., 8vo. Boston, 1908. *The Author.*

Michigan. Thirty-fifth Annual Report of the Secretary of the State Board of Health of the State of Michigan, 1907. 188 pp., 8vo. Michigan, 1908. *The Board.*

Oliver, *Thomas, M.D., F.R.C.P.* Diseases of Occupation from the Legislative, Social, and Medical Points of View. 427 pp., 8vo. London, 1908. *The Author.*

Orsett R.D.C. Report for 1907, with Financial Statements and Reports of Officers. 28 pp., 8vo. Grays, 1907. *W. Whitaker, B.A., F.R.S.*

Ravenhill, *Miss Alice.* Some Characteristics and Requirements of Childhood, 71 pp., 8vo. Leeds, 1908. *E. J. Arnold & Son, Ltd. (publishers).*

Registrar-General. Fifty-second Detailed Annual Report of Births, Deaths, and Marriages in Scotland. Abstracts for 1906. 577 pp., 8vo. London, 1908. *The Registrar-General.*

Royal Commission of Sewage Disposal. Third, Fourth, and Fifth Reports of the Commissioners on what Methods of Treating and Disposing of Sewage may properly be adopted. 1252 pp., fcap. London, 1908.

——— Fourth Report of the Commissioners on what Methods of Treating and Disposing of Sewage may properly be adopted. Vol. IV., Parts I., II., III., IV., V. 846 pp., fcap. London, 1908.

——— Fifth Report of the Commissioners appointed to Inquire and Report what Methods of Treating and Disposing of Sewage may properly be adopted. Methods of Treating and Disposing of Sewage. Appendix I. Minutes of Evidence. 803 pp., fcap. London, 1908.

——— Supplementary Volumes presented with the Fifth Report of the Commissioners appointed to Inquire and Report what Methods of Treating and Disposing of Sewage may properly be adopted. Appendix VI. Report by Professor Letts and Dr. W. E. Adeney on the Pollution of Estuaries and Tidal Waters. 562 pp., fcap. London, 1908.

——— Interim Report of the Commissioners on what Methods of Treatment and Disposing of Sewage may be adopted. Vol. III., Appendices. 534 pp., fcap. London, 1908. *Purchased.*

Staffordshire C.C., Education Committee: The Planning of Schools with Special Reference to Ventilation. 18 pp., 8vo. Stafford, 1908. *G. Reid, M.D.*

Transvaal. Government Laboratories: Annual Report, 1906–7. 37 pp., fcap. Pretoria, 1908. *J. McCrae, Government Analyst.*

Wallis, *H. Sowerby.* Obituary Notice of George James Symons, F.R.S., the Founder of the Rainfall Organisation. 8 pp., 8vo. *W. Whitaker, B.A., F.R.S.*

Whelpton, *W. P., B.Sc.* Principles and Methods of Physical Education and Hygiene. 401 pp., 8vo. London, 1908. *University Tutorial Press, Ltd.*

Wilkinson, *Major E., F.R.C.S., D.P.H., and* **Bagley,** *W. A.* Report of the Sanitary Administration of the Punjab, and Proceedings of the Sanitary Board for the year 1907, by Major E. Wilkinson, and the Report on Sanitary Works for 1907 by W. A. Batley. Fcap. Lahore, 1908.
Major Wilkinson, F.R.C.S., D.P.H.

Wilkinson, *Major E., F.R.C.S., D.P.H.* Report on Vaccination in the Punjab for the year 1907–1908. 19 pp., fcap. Lahore, 1908. *The Author.*

COLONIAL NOTES.

Mr. Edwin Cuthbert of Christchurch, N.Z., has sent some notes on sanitary work as the result of 25 years' practical experience, a summary of which may be of interest:—

With regard to the grades and sizes of sewer pipes he considers that a much flatter grade for sewer pipes could be safely adopted than the generally accepted one of 1 inch in 430 for a 9-inch pipe.

In the flat district of Christchurch, N.Z., where 1 in 525 was the best grade obtainable, he has found that work with complete efficiency.

It has been necessary to adopt a grade of 1 in 600 in one part of the city, and there has been no sign of deposit in the pipe after a couple of years' use, and he considers that even a flatter grade might be adopted if road grit were rigidly

excluded and flushing amply provided for. With these conditions he has working with complete efficiency 15-inch pipes at a grade of 1 in 960, 12-inch at 1 in 860, and 6-inch at 1 in 400. As regards the sizes of soil and waste pipes he can state authoritatively that no vertical soil-pipe need be more than 3 inches in diameter. He has never known a stoppage to occur in the vertical portion of a 3-inch pipe, even where he has twelve closets served by such a pipe.

In ventilating public sewers he places the gully or water-closet trap at the head of each drain, and, if there are branches, at the head of each branch, and makes each house main ventilator ventilate the public sewers, the fresh air inlets being open grids at the street surface. He holds that openings in the street need not be offensive if the ventilating is properly effective.

He is convinced that no reasonable system of sewer ventilation can be devised without frequent fresh air inlets at the street surface.

The following additional Examiners have been elected by the Council to serve on the Colonial Boards:—

British South Africa.—John James Boyd, M.D., M.B., C.M., D.P.H., M.O.H., Pretoria.

Hong Kong and South China.—Patrick Nicholas H. Jones, A.M.I.C.E., Assistant-Director, Public Works.

Tasmania.—G. H. Edwards, C.E.

Western Australia.—John H. S. Cumpston, M.D., M.B., D.P.H., M.O.H., Central Board of Health, Perth.

New South Wales.—Reginald Jeffrey Millard, M.B., M.Ch., D.P.H., J.P., Dept. Public Health, Sydney.

GENERAL NOTES.

Sanatoria for Consumptives.—The Journal of the Institute, Vol. XXVI., page 357, contains a description and an illustration of the Sanatorium at Frimley, which was designed by Mr. Edwin T. Hall. It is interesting to note that this building, which was visited and discussed by Members of the Institute, received the first prize at the International Congress on Tuberculosis at Washington, and at Milan in the previous year two Gold Medals were awarded to designs by the same Architect for Association Hospitals and Sanatoria.

It is gratifying that two countries, East and West, have recognised England as leading in hospital construction.

An International Exhibition of Hygiene is to be held in connection with the 4th Latin American Medical Congress at Rio de Janeiro (Brazil) during the months of August and September, 1909. The Exhibition will be held under the auspices of the Brazilian Government, who will grant exemption from Custom House duties on all articles for the Exhibition. All particulars can be obtained from the Commissioner-General, Dr. A. da Graca Couto, Rua Uruguayana, n. 5, Rio de Janeiro.

THE ROYAL SANITARY INSTITUTE.

REVIEWS OF BOOKS.

The Sanitation on Recreation Camps and Parks.*

This small work is intended to shew how to apply those sanitary laws which experience and scientific knowledge have enabled us to formulate for settled communities, in recent years, to the establishment and management of temporary habitations in the wilds of nature.

Such knowledge is necessarily of more value in America than in this country, but, *mutatis mutandis*, there is much good advice, here given, which is equally sound for residents in our own country districts as for the backwoodsman, for laying out, building, and managing a navvies' village, as a settlement of log cabins.

As illustrating the evil results of lack of fresh air in sleeping rooms, even amidst the healthiest external surroundings, the writer mentions that the Sioux Indians from 1878 onwards died in great and increasing numbers from phthisis, after abandoning the tepee and taking up residence in huts or houses.

In referring to water supplies for camps, he mentions the obvious liability of streams, even in more or less remote regions, to contamination from camps and settlements established on or near their banks.

He gives a set of sanitary rules adopted and observed in a woodland camp to which he was attached, which are excellent in their import, but it is hardly necessary to say—very difficult to enforce.

He deplores the tendency of all classes of persons using public parks, and other places of recreation and resort, to scatter broadcast all manner of polluting and disfiguring refuse around their stopping places and along their trail. The public parks of the States are, of course, *sui generis*, and some of their endemic diseases, like malaria and yellow fever (both mosquito borne), do not arise locally with us; still, there is sufficient analogy between the places dealt with and the conditions described by Dr. Bashore, and those of which many of us have experience in this country, to make his remarks both interesting and instructive to us.

But, although books of this description contain useful information, they seldom do much good, and this for the simple reason that the source of the evils they deplore is not so much ignorance as incurable selfishness. P. B.

Your Child's Health.†

Medical Notes for Mothers and Teachers, School Nurses, and Health Visitors.

This book contains an immense amount of information suitable for intelligent mothers, school teachers, health visitors, and others upon whom devolves the care or health-inspection of infants and young children. It is impossible to

* The Sanitation of Recreation Camps and Parks, by Dr. Harvey B. Bashore, 103 pp., 8vo. New York, 1908. John Wiley & Sons.

† Your Child's Health, by John Grimshaw, M.D., B.S.Lond., D.P.H. 141 pp., 8vo. London, 1908. J. & A. Churchill. 2s. 6d. net.

epitomise the work, so wide is the range of its subjects—from the care of the Expectant Mother's health to the Board-of-Education-Code Building Regulations for Public Elementary Schools (Appendix).

From a literary point of view the book necessarily suffers through the severe condensation which the writer has practised, almost without exception, throughout. But, as a notebook for ready reference by interested persons athirst for useful knowledge, it gains considerably by such treatment, for, however brief the author may be, his meaning is seldom doubtful.

In offering information on medical subjects, however, to the laity, whether gentle or simple, it behoves us to be very exact in all cases where this is possible, and to state plainly when it is not. Although Dr. Grimshaw has given much useful and quite reliable medical information and advice in this work upon a vast number of important matters, there are certain points which will require revision in a later edition. For example, we are told that the period of isolation for cases of diphtheria is from two to three weeks. Now, in isolation hospitals dealing with large numbers of diphtheria cases, we know that it is seldom possible to discharge such cases under an average period of seven to eight weeks, when the criterion of negative bacterial diagnosis is adopted: and we justly infer, therefore, that such a period of isolation is normally required.

Again, in dealing with the subject of adenoids, the author states that they "are easily cured by a simple operation," whereas no such generalisation is justified by experience. In a large number of cases the benefit of operations is only transient at best, and parents and others misinformed on this point, are liable to suffer grievous disappointment, and prone to attribute negligence or malpraxis to surgeons operating upon their children who fail to achieve the impossible.

These blemishes in the book, however, are readily removable, and will doubtless disappear in later editions.

To add emphasis to the necessity for co-operation on the part of teachers, school nurses, and health visitors (where such exist), and parents and guardians, in the medical inspection of school children, if such inspection is to prove effective and successful, the writer wisely quotes extracts from the Memorandum (of November, 1907) issued by the Board of Education. He also mentions the Examination for School Nurses and Health Visitors recently established by The Royal Sanitary Institute. P. B.

Military Hygiene.*

A Manual of Sanitation for Soldiers.

This book, as its title explains, is written for the instruction of soldiers in the principles of hygiene—now (by Army Order 3, 1908) a compulsory subject of examination for candidates for promotion to the rank of captain.

The writer points out that health is an essential factor of efficiency in soldiers, and that, the latter being for the most part picked men in the prime of life, failure of their health is almost necessarily due in most instances to preventable causes. That much has been done during the past fifty years to protect soldiers from disease risks is shewn by contrasting the sickness and death-rates of fifty years ago with those of the present day. Whereas the health of soldiers fifty

* Military Hygiene, a Manual of Sanitation for Soldiers, by Lieut.-Col. R. H. Firth, R.A.M.C., F.R.C.S., D.P.H. 295 pp. 8vo. London, 1908. J. & A. Churchill.

years ago compared very unfavourably with that of the general male population of corresponding ages, at the present day the opposite condition obtains, and soldiers are now much healthier than their fellows in the general population. The amount of sickness and mortality, however, varies much with locality, and we learn that the mortality is "about trebled by foreign service,"—mainly through such causes as enteric, malarial and other fevers.

The causes of disease (from *materies morbi* to personal susceptibility) are dealt with in simple popular language, then the actual diseases themselves; and after this, in separate chapters, the principles of prevention and the organization of preventive work.

In dealing with the subject of disinfection, the author points out the frequent difficulty of tracing in crowded soldiers' quarters the bedding, clothing, and other goods of particular individuals: a fact which strongly emphasises the necessity of strict sanitary discipline and intelligent co-operation in every unit.

The headings of the later chapters sufficiently explain their import. These headings are as follows:—The Recruit; The Physical Training of the Soldier; The Barrack; Water Supplies (a specially well-written section); The Food of the Soldier; Clothing, Equipment, and Work of the Soldier: and, finally, The March and The Camp.

The book is written in simple language, and contains much information of the highest possible utility to the soldier. It is well fitted, therefore, to become a manual of general instruction on health matters for all grades in all branches of the service. P. B.

Practical Hints to Health Visitors.*

This booklet contains the substance of seven lectures delivered in Dublin during 1905, at the instance of the Diocesan Councils of the Mothers' Union and Girls' Friendly Societies. The lectures deal with (*a*) the feeding and management of infants, (*b*) the management of children during school life, (*c*) the dwelling, and (*d*) food and beverages.

Similar lectures with a like object have recently been delivered in London, Manchester, Nottingham, and elsewhere. When the information which such lectures afford reaches the ears and understanding of intelligent workers among the poor, like district visitors, the lectures cannot fail in some measure to achieve a useful purpose. If those who have obtained the confidence and respect of the poor as instructors in religion, morals, and thrift, will also adopt the role of health missioners, they will thereby greatly increase the interest of their philanthropic work to themselves, and the utility of it to their poorer neighbours and the community at large. The usefulness of such ministration, indeed, as a means of contributing to a solution of the great housing problem, by improving the poor home from within, is apparent on the face of it. P. B.

Some Characteristics and Requirements of Childhood.†

The substance of this small work appeared in *The Guardian* during the winter of 1905-6, and the original articles, revised and largely re-written,

* Practical Hints to Health Visitors, by Greta Allen, A.R.San.I. 86 pp. London 1908. The Scientific Press, Ltd.

† Some Characteristics and Requirements of Childhood. By Alice Ravenhill, F.R.San.I., 71 pp., 8vo. E. J. Arnold & Son. Leeds and Glasgow, 1908.

constitute a handy and well written digest of matters which are comprised within the title given to the book.

To those parents and teachers who cannot find the time or the opportunity for studying more detailed expositions (of which a useful bibliography is appended), Miss Ravenhill has performed a genuine service.

All parents should know and appreciate the facts herein presented: and it is to be hoped that the work will be extensively read by them and also by those whose duty it is to convey such knowledge to prospective parents.

It goes without saying that the facts stated and the advice given by Miss Ravenhill are strictly in accordance with the findings of science and practical experience, and there is no statement to which the most captious critic can take exception. H.R.K.

MEETINGS HELD.

Examinations.

Sanitary Science as applied to Buildings and Public Works.

London, Nov. 27th and 28th ... 28 Candidates: 15 Certificates granted.
Manchester, Dec. 11th and 12th 7 Candidates: 2 Certificates granted.

Hygiene in its bearing on School Life.

London, Nov. 27th and 28th ... 9 Candidates: 3 Certificates granted.
Manchester, Dec. 11th and 12th 2 Candidates; 1 Certificate granted.

Women Health Visitors and School Nurses.

London, Nov. 27th and 28th ... 10 Candidates: 4 Certificates granted.
Manchester, Dec. 11th and 12th 9 Candidates: 5 Certificates granted.

Inspectors of Nuisances.

London, Nov. 27th and 28th ... 98 Candidates; 48 Certificates granted.
Manchester, Dec. 11th and 12th 60 Candidates: 22 Certificates granted.

Inspectors of Meat and other Foods.

London, Dec. 18th and 19th ... 44 Candidates: 29 Certificates granted.

Candidates who have received Certificates.

Sanitary Science as applied to Buildings and Public Works.

Ball, Francis Charles.
Barker, George S. E.
Bishopden, Harold.
Brazier, Henry Arthur.
Clark, Alexander.
Heldtch, George Wells.
Meville de Cruz, Thomas.
Mody, Ardeshir S. F.
Mumford, Frank Septimus.
Pierce, Edward Lemuel.
Seymour, Harry William.
Smith, Albert Edward.
Steward, Donald Henry.
Timothy, Ernest.
Turner, Harold George.
Vaughan, Thomas.
Webb, Horace Christian.

Hygiene in its bearing on School Life.

Eaton, Harrington Holloway.
Gallico, Eva.
Mühlhäuser, Jessie.
Spalding, Muriel Howard.

Women Health Visitors and School Nurses.

Bond, Winifred Mary.
Cossens, Margery Elizabeth.
Godden, Dorothy.
Gough, Alice.
Hanson, Ada.
Mc Dowall, Isabella Jessie.
Pringle, Adelaide Jane.
Skinner, Elsie Mary.
Watkins, Selina Elizabeth Bellona.

Inspectors of Nuisances.

Aldous, Robert Crafts.
Allman, George.
Anderson, Florence Annie.
Baber, Edgar.
Barf, James.
Beeney, Herbert.
Biggs, Bertie John.
Blakeman, John.
Blow, Thomas Bertram.
Buller, Elizabeth Russell.
Carter, Harry.
Cleave, Anna Veysey Mary.
Clipson, Samuel.
Cole, Frederick John.
Cooksey, Agnes Mary.
Copeland, Willie.
Cullin, Harry Barton.
Curd, James Edward.
Daintith, James.
Das, Bilas Chandra.
Davidson, Robert.
Davies, Owen.
Dennett, Alfred Frid.
Drake, Sidney Reginald.
Ebbs, Joseph Laurence Tyssen.
Evans, George Edwin.
Fullerton, Annie Mary.
Gallivan, John.
Gill, John.
Goldfinch, William James.
Gray, Wilfrid John.
Hampton, Hugh Stafford.
Hancock, Harold Herbert.
Hart, Leonard Sydney Ross.
Hennings, Sydney.
Holt, Wilfrid.
Jenkins, Rowland Henry.
Jenner, Mark.
Johnson, William Herbert.
Kelly, Henry.
Lavender, William Anthony.
Letters, Fanny Riordan.
Lingwood, Gerald William.
Mack, Arthur Henry.
McKay, Christina Alexandria Tait.
Magowan, Ethel Florence.
Margerrison, Francis Henry.
Matton, Else Julia.
Mortimer, Samuel.
Newhall, Dorothy Minnie.
Palmer, Sidney.
Penfold, William Frederick.
Pile, Frederick Stanley.
Price, Herbert.
Ramsden, Fred.
Reddoch, Annie Eliza.
Reed, Benjamin Samuel.
Rentforth, Thomas Langton.
Robinson, Ernest Brien.
Saunders, William Ernest.
Shackleton, George.
Spencer, Henry.
Stanley, Owen Geoffrey.
Thomas, George Herbert.
Taphouse, Harry.
Walton, Percy.
Waters, Bertram Cecil.
White, Frank Rice.
Wilds, Eustace.
Wilshere, William Meowin.

Inspectors of Meat and other Foods.

AINLEY, ALBERT.
BALDWIN, ERNEST WILFRED.
BROWN, ESMOND.
CORDEN, CHARLES FREDERICK.
DALTRY, JOHN.
DAVIES, HENRY, *Major, A.S.C.*
DELAVOYE, ALEXANDER EDWIN, *Maj.*,
EVANS, THOMAS RICHARD. [*A.S.C.*
FRENCH, FRANCIS HAROLD.
FRENCH, GEORGE ARTHUR, *Col., A.S.C.*
HERRIN, JOHN.
HUMPHREYS, HARRY LIONEL, *Lt.-Col.*,
LAKE, HERBERT A., M.R.C.V.S. [*A.S.C.*
NEWELL, THOMAS.
NORRINGTON, FREDERIC CONRAD SWITHIN, *Major, A.S.C.*
OWEN, JOHN.
PALMER, JOSEPH BUCKLEY.
PEARSON, JOHN.
REYNOLDS, SIDNEY LATIMER, *Maj. A.S.C.*
REID, ALFRED WILLIAM, F.R.C.V.S.
SCOTT, GEORGE LATIMORE.
SHILSTON, ARTHUR W.
SMITH, HORACE RUSSELL.
SNOWDON, JOHN VINEY.
STANLEY, RALPH SILK.
TERRY, ASTLEY, *Lt.-Col., A.S.C.*
WELLINGTON, CHARLES PERCY, M.R.C.V.S.
WHIPP, ALFRED HERBERT.
YOUNG, JOHN STOW, M.R.C.V.S.

FORTHCOMING MEETINGS.

SESSIONAL MEETINGS.

LONDON.—Wednesday, January 13th, Discussion on "The Purification of Water by Ozone and other Chemical Substances," to be opened by S. Rideal, D.Sc., F.I.C., F.C.S. The Chair will be taken at 8 p.m. by E. B. Barnard, Esq., M.P. (Chairman, Metropolitan Water Board).

MANCHESTER.—Friday, January 22nd, Visit to the New Royal Infirmary at 2.30 p.m. Meeting in the School of Technology at 7 p.m., when a discussion will take place on "The Manchester Royal Infirmary, from the Hygienic, Sanatory, and Æsthetic Points of View"; opened by Mr. Edwin T. Hall, V.-P.R.I.B.A., followed by Mr. John Brooke, F.R.I.B.A., the Architects of the Infirmary.

EXAMINATIONS.

In Sanitary Science as applied to Buildings and Public Works, for Inspectors Qualifying for Membership, for Inspectors of Nuisances, in Hygiene in its Bearing on School Life, and for Women Health Visitors and School Nurses—

Plymouth, January 29th and 30th.
Hull, February 26th and 27th.

Inspectors of Meat and other Foods—
Newcastle, February 19th and 20th.

LECTURES.

The 47th Course of Lectures and Demonstrations for Sanitary Officers will commence on February 1st.

The 14th Course of Practical Instruction in Meat Inspection will commence on February 19th.

Course of Lectures on Sanitary Science as applied to Buildings and Public Works, will commence on February 19th.

The Special Course on Food and Meat Inspection, arranged for Army Officers and Professional Men, will commence on April 19th.

Course of Lectures on Hygiene in its bearing on School Life, and for Women Health Visitors and School Nurses, will commence on February 19th.

Calendar for January and February, 1909.

As far as at present arranged.

JANUARY.

13 W. **Sessional Meeting,** London, at 8 p.m. Discussion on "The Purification of Water by Ozone and other Chemical Substances," to be opened by S. Rideal, D.Sc. F.I.C., F.C.S. The Chair will be taken by E. B. Barnard, Esq., M.P., Chairman, Metropolitan Water Board.

22 F. **Sessional Meeting,** Manchester. Visit to the new Royal Infirmary at 2.30 p.m. Meeting in the School of Technology at 7 p.m., when a discussion will take place on "The Manchester Royal Infirmary, from the Hygienic, Sanatory and Æsthetic points of view"; opened by Mr. Edwin T. Hall, V-P.R.I.B.A., followed by Mr. John Brooke, F.R.I.B.A.

29 F.
30 S. } Examinations—Plymouth.

FEBRUARY.

1 M. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, A: Introductory Remarks, Public Health Acts—English, Scotch, Irish; other Statutes relating to Public Health; By-laws (Model, etc.), Regulations, Orders, Memoranda, etc., by Charles Porter, M.D., B.Sc., M.O.H. Finsbury.

3 W. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, B: Public Health (London) Act; Metropolis Local Management Acts; By-laws and Regulations in force in the Administrative County of London, by Charles Porter, M.D., B.Sc.

5 F. Lecture to Sanitary Officers at 7 p.m. Sanitary Law, C: Factory and Workshop Acts (including Bakehouse Legislation, 1878–95) as they affect the Sanitary Inspector; Smoke Legislation; Food and Drugs Acts, 1899, by Charles Porter, M.D., B.Sc.

8 M. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—General, A: Outdoor, by A. Wellesley Harris, M.R.C.S., D.P.H., M.O.H., Lewisham.

10 W. Inspection and Demonstration in the District of Islington, at 2 p.m. (number limited). Conducted by James R. Leggatt, Supt., Public Health Dept., Borough of Islington.

10 W. Lecture to Sanitary Officers, at 7 p.m. Duties of a Sanitary Inspector—General, B: Indoor, by A. Wellesley Harris, M.R.C.S., D.P.H.

12 F. Lecture to Sanitary Officers at 7 p.m. Duties of a Sanitary Inspector—C: Offensive Trades and Trade Nuisances, etc., by A. Wellesley Harris, M.R.C.S., D.P.H.

15 M. Lecture on School Hygiene in its bearing on School Life for Women Health Visitors and School Nurses, at 7 p.m., on General Structure of the Body, by Prof H. R. Kenwood, M.B., D.P.H.

15 M. Lecture to Sanitary Officers at 7 p.m. "Infectious Diseases," by G. F. McCleary, B.A., M.D., D.P.H., M.O.H. Hampstead.

16 Tu. Demonstration of Book-keeping as carried out in a Sanitary Inspector's Office, at the Public Health Office, Town Hall, Upper St., Islington, N., at 6 p.m., by James R. Leggatt, Supt. Public Health Dept., Borough of Islington.

MARCH.

24 W. **Annual Meeting of Associates.**

APRIL.

28 W. **Ordinary General Meeting,** at 4.30 p.m.

LIST OF MEMBERS AND ASSOCIATES ELECTED,

DECEMBER, 1908.

MEMBERS.

Reg. No.	Date of Election.	
[illegible]	1908. Dec.	BARNES, Frederick Arthur, ASSOC.M.INST.C.E., *Town Hall, Upper Street, Islington, N.*
[illegible]	1908. Dec.	BRIDGE, J. F., D.P.H., M.B., 80, *Dale End, Birmingham.*
[illegible]	1908. Dec.	BROWN, J. T., 190, *Kingston Road, Wimbledon.*
[illegible]	1908. Dec.	CORFIELD, Walter Francis, M.B., B.S.LOND., M.R.C.S., L.R.C.P., D.P.H.CANTAB, 26, *Old Burlington Street, London, W.*
[illegible]	1908. Dec.	DOWNING, Henry Philip Burke, F.R.I.B.A., F.S.I., 12, *Little College Street, Westminster, S.W.*
[illegible]	1908. Dec.	GHADIALI, M. R., B SC.TECH., 1, *Cumberland Terrace, Finsbury Park Gate, N.*
[illegible]	1908. Dec.	MILLER, John W., M.D., CH.B., D.P.H., (*M.O.H.*), *Public Health Dept., Town Hall, Hereford.*
[illegible]	1908. Dec.	MINETT, Edward Pigott, M.D., M.R.C.S., L.R.C.P. D.P.H., *Guy's Hospital, S.E.*
[illegible]	1908. Dec.	NEW, J. Sherwood, M.B.LOND., D.P.H.CANTAB., L.R.C.P., M.R.C.S. 35, *Harrington Square, N.W.*
[illegible]	1908. Dec.	SCOTT, Robert, M.D., CH.M., 704, *Sturt Street, Ballarat, Victoria.*
[illegible]	1908. Dec.	SMEDLEY, Ralph, D., M.A., M.D., D.P.H., M.R.C.S., *The Peth, Durham.*
[illegible]	1908. Dec.	WILLIAMS, W. M. Venables, L.R.C.P., L.R.C.S. (*M.O.H.*), *Bryn, Wynstay Road, Colwyn Bay, N. Wales.*

ASSOCIATES.

‡ Marked thus have passed the Examination of the Institute for Inspectors of Nuisances.

V Marked thus have passed the Examination for Women Health Visitors and School Nurses.

M Marked thus have passed the Examination for Inspectors of Meat and Other Foods.

Reg. No.	Date of Election.	
[illegible]	1908. Dec.	‡BAGNALL, Miss Elizabeth, 318, *Derby Road, Bootle, Liverpool.*
[illegible]	1908. Dec.	‡BUTTERWORTH, Charles Ernest, 92A, *Claypath, Durham.*
[illegible]	1908. Dec.	‡CLARK, Robert Boston, 36, *Ashley Road, Tyne Dock, South Shields.*
[illegible]	1908. Dec.	‡COLES, Albert, *Bloomfield House, Peasedown St. John, Bath.*
[illegible]	1908. Dec.	‡CRUTTENDEN, Arthur B., 24, *Killyon Road, Larkhall Rise, Clapham, S.W.*

4361 1908. Dec. ♪ DAVIES, Miss Katie, *Queen's Nurses' Home, Blackburn.*
4362 1908. Dec. ‡DODD, Thomas William, 40, *Kingsgate Terrace, Hexham.*
4363 1908. Dec. ‡EDGAR, David Campbell, 108, *Hawthorne Road, Bootle, Liverpool.*
4364 1908. Dec. ‡FOLLAND, Gordon R., 8, *Fort Terrace, Barnstaple, Durham.*
4365 1908. Dec. ‡GOVETT, Philip Brenton, *Tideford, St. Germans, Cornwall.*
4366 1908. Dec. ‡HANCOCK, Clarence Coles, *Glen View, Radstock, Somerset.*
4367 1908. Dec. ‡HARRIS, Francis John, 2, *Fortescue Terrace, Tavistock.*
4368 1908. Dec. ‡KNEE, W. H., *Fosley, Newton Abbot, Devon.*
4369 1908. Dec. ‡LARMOUR, William John, 58, *Raby Street, Belfast.*
4370 1908. Dec. ‡LIGHT, Benjamin George, "*Greenbank,*" *Highgate Road, Copnor, Portsmouth.*
4371 1908. Dec. ‡LOTINGA, Alfred G., *Architect's Dept., N.E.R., Newcastle-upon-Tyne.*
4372 1908. Dec. ♪ MACWILLIAM, Miss Madeline, *Ruchill Hospital, Glasgow.*
4373 1908. Dec. ‡PERKINS, William Edward, 34, *Hill Street, Jarrow-on-Tyne.*
4374 1908. Dec. ‡PHILLIPPS, Arthur Stacey, 1, *Windsor Villas, Pill, Somerset.*
4375 1908. Dec. ‡PICKERING, Herbert, 1, *Summerhill Street, Newcastle-on-Tyne.*
4376 1908. Dec. ‡RAINE, Harry Eubank, *Surveyor and Sanitary Inspector's Office, Barnard Castle, Durham.*
4377 1908. Dec. ‡RIDLEY, James Robson, *Surveyor and Inspector, Stanhope S.O., Durham.*
4378 1908. Dec. ‡RIDLEY, William, *Beaconsfield Terrace, South Shields.*
4379 1908. Dec. M ROSS, William Lecky, 15, *Tootal Road, Weaste, Manchester.*
4380 1908. Dec. ‡RUSSELL, David, 5, *Woodland Road, Seaforth.*
4381 1908. Dec. ‡WATSON, Arthur, *The Health Dept., Municipal Council,* 1, *Honan Road, Shanghai, China.*
4382 1908. Dec. ‡WEARING, Miss Bertha Elizabeth, 50, *Dallas Road, Lancaster.*
4383 1908. Dec. ‡WILLDER, Miss Gladys May, 6, *Sefton Road, Formby, Lancashire.*
4384 1908. Dec. ‡WILLIAMS, Daniel, 154, *North Hill Street, Liverpool.*
4385 1908. Dec. ‡WILSON, Robert Edmanson, *Council Offices, North Street, Oundle.*
4386 1908. Dec. ‡WOOD, Horace, 3, *Evington Street, Leicester.*

CONTRIBUTIONS AND ADDITIONS TO LIBRARY.*

**** *For Publications of Societies and Institutions, etc., see under "Academies."*

Bovey. *Dr. Henry T.* The Aims and Objects of the Imperial College of Science and Technology. *The Author.*

Bradford. *Technical College.* General and Departmental Reports for Session 1907-8. 8vo. Bradford, 1908. *The Principal.*

Brooke. *G. E., M.A., L.R.C.P.* Essentials of Sanitary Science. 413 pp., 8vo. London, 1908. *Henry Kimpton (publisher).*

McLean. *C. J. Russell. M.D., D.P.H.* Guide to the Examination of School Children, for the use of School Medical Officers. 4 pp., 8vo. London, 1908. *The Sanitary Publishing Co., Ltd.*

MEDICAL OFFICERS OF HEALTH & OTHER SANITARY REPORTS.

Aberdeen, September, 1908 .. .. *Matthew Hay, M.D.*
,, October, 1908 .. .. *Kenneth Cameron.*
Berkshire C.C., 1907 .. .. .. *Gerard C. Taylor, M.A., M.D., D.P.H.*
Cornwall C.C., October, 1908 .. *John R. de C. Boscawen.*
Huddersfield, 3rd Quarter, 1908 .. *S. G. Moore, M.D., D.P.H.*
Lancaster C.C., 1907 .. .. .. *E. Sergeant, M.D.*
London, Four Weeks ending 14th November, 1908 .. .. .. *W. Collingridge, M.D., D.P.H.*
Manchester (Rivers Department), for Year ending March 25th, 1908 .. *Ald. J. Frowde.*
Montreal, 1907 .. .. .. *Dr. L. Laberge.*
Newport, 1907 .. .. .. *J. Howard-Jones, M.D., D.Sc., C.M.*
Nottinghamshire C.C., 1907 .. . *Henry Handford, M.D., D.P.H.*
Staffordshire C.C., 1907 .. .. *George Reid, M.D., D.P.H.*
Wiltshire C.C., 1907 .. .. .. *J. Tubb-Thomas, M.D., D.P.H.*

New Zealand. *Public Health Department.* Annual Report. 149 pp., feap. Wellington, 1908. *J. M. Mason, M.D., L.R.C.P.*

The Surgeon-General. United States Army. Index-Catalogue of the Library of the Surgeon-General's Office, United States Army. 929 pp., 4to. Washington, 1908. *The Surgeon-General.*

HEALTH EXHIBITION, CARDIFF, 1908.

ADDITIONAL AWARD FOR EXHIBIT SELECTED FOR FURTHER TRIAL.

BRONZE MEDAL.

THE SANITARY FLOOR COMPANY. "Dustolio."

* Members or Associates wishing to file or catalogue these Titles can, on application, be supplied with excerpt copies for this purpose.

THE FOLLOWING JOURNALS AND PERIODICALS HAVE BEEN RECEIVED IN THE LIBRARY DURING 1908.

WEEKLY.

British Architect.
British Journal of Nursing.
British Medical Journal.
Builder.
Builders' Journal and Architectural Engineer.
Contract Journal.
Domestic Engineering.
Engineering.
Hardware Trades Journal, The.
Health.
Indian Engineering.
Journal d'Hygiène.
Journal of the Society of Arts.
Lancet.
Local Government Chronicle.
Local Government Journal.
Local Government Officer.
London County Council Gazette.
Municipal Journal.
Nursing Times.
Sanitarisch-demographisches Wochenbulletin der Schweiz.
Sanitary Record.
Surveyor and Municipal and County Engineer.
Veterinary Record.
" News.

MONTHLY, Etc.

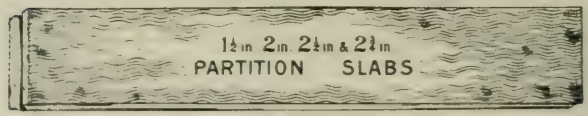
Annales des Ponts et Chaussées.
British Journal of Inebriety.
British Journal of Tuberculosis.
Bulletin du service de Santé et de l'Hygiène publique (Bruxelles).
Canadian Nurse.
Child-Study.
Chicago Health Bulletin.
Concrete.
Deutsche Vierteljahrsschrift für öffentliche Gesundheitspflege.
Direzione Generale dell' Amministrazione Civile. Bollettino Sanitario.
Engineering Magazine.
Giornale della Reale Società Italiana d'Igiene.
Glasgow Medical Journal.
Indian Public Health.
Iowa Health Bulletin.
Journal of Hygiene.
Journal of the American Public Health Association.
Journal, American Institute of Architects.
Journal of the Institute of Sanitary Engineers.
Journal of the Royal Institute of British Architects.
Journal of the Royal Institute of Public Health.
Journal of the Royal Meteorological Society.
Journal of the Royal Army Medical Corps.
Journal of the Royal Statistical Society.
Journal of the Sanitary Inspectors' Association.
Journal of the Society of Architects.
La Ingenieria.
La Salute Pubblica (Perugia).
La Technologie Sanitaire.
Le Génie Sanitaire.
Le Mois Medico-Chirurgical.
Meteorological Record.
Museums Journal, The.
New York State Board of Health, Monthly Bulletin.
Plumber and Decorator.
Progress.
Public Health.
Registrar-General's Returns: England and Wales, Scotland, and Ireland. Weekly, Monthly, and Quarterly.
Revue d'Hygiène et de Police Sanitaire.
Royal Engineers' Journal.
Sei-i-Kwai Medical Journal.
Surveyors' Institution, Transactions of.
Symons's Meteorological Magazine.
Tablettes Mensuelles de la Société Royale de Médecine publique.
Technology Quarterly and Proceedings of the Society of Arts (Massachusetts).
Water.

EXHIBITS FOR WHICH MEDALS HAVE BEEN AWARDED AT THE HEALTH EXHIBITION, CARDIFF, 1908.

"Mack" Slabs for Partitions and Roofs.

Bronze Medal.

To T. G. Williams & Co. (Agents for J. A. King & Co.)



The slabs are composed principally of plaster, having reeds embedded, thereby forming sealed air chambers for insulating against both high and low temperatures, also sound, and further gives strength with additional lightness: and as the slabs contain no metal work, they may be sawn and nailed like wood. Isolation hospitals may be erected entirely with these slabs.

Sizes.—Slabs $\frac{5}{8}$ in., $\frac{3}{4}$ in., 1 in., $1\frac{1}{4}$ in., and $1\frac{1}{2}$ in. thick for ceilings, stud partitions, insulation of roofs, lining corrugated iron buildings and damp walls, etc.. Slabs 2 in., $2\frac{3}{4}$ in. and 4 in. (hollow) thick for forming solid partitions any length, floors pugging, insulation of refrigerators and roofs.

Prices.—From 10d. per yard super.

Manufactured by J. A. King & Co., 181, Queen Victoria Street, E.C.

Conical Cross-bar Penstocks.

Bronze Medal.

To Adams-Hydraulics Ltd., York.

The Mowbray Tipping Ashbin.

Bronze Medal.

To KIRTLEY & SON, LTD.

The frame is made of strong cast-iron in sections, which are put together easily, when built into the wall and bonded in the brickwork; it is secure, and requires no pointing whatever. The bin is made of strong galvanised steel, and is especially shaped to prevent offensive matter adhering, and it has a waterproof hinged cover fixed above the bin. The Ashbin is fitted in the wall of the back yard, and is opened by the scavengers from outside with a key, and is tipped right over so as to allow the contents to fall into a receptacle beneath, which is then simply lifted up and emptied into a cart standing alongside.

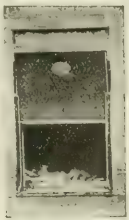
PRICES.—21s. 6d., free on rail, Sunderland.

Manufactured by KIRTLEY & SON, LTD., Sunderland.

Mowbray Earth-Closet Hatch.

Bronze Medal.

To KIRTLEY & SON, LTD.



The "Mowbray" Hatch has a metal frame and steel door, the frame being built into the wall, and flush with the face of it, there is no space for the filth to accumulate. The door closes tightly on sole plate, and this largely prevents liquid matter oozing out, defacing the brickwork.

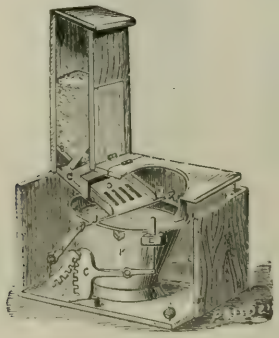
PRICE.—From 10s. 6d. each, free on rail, Sunderland.

Manufactured by KIRTLEY & SON, LTD., Sunderland.

Self-acting Earth Closet.

Silver Medal.

THE BRITISH SANITARY CO.



When the closet is being used, the seat is depressed about an inch, forcing down the rods EE on each side of the seat, which raise the long and weighted end of the segmental toothed levers G and G, which in turn throw back the long end of the lever H. This duplex action is coupled by the cross bar J, to which is attached the shovel D: this is then withdrawn to the back of the bevelled shelf C, and receives the charge of earth, etc. When the seat is relieved, the weight of the lever brings out the shovel quickly, thus spreading the earth, etc., over the excreta.

Prices on application.

Manufactured by THE BRITISH SANITARY CO., 341, Bath Lane, Glasgow.

Lead Pipes.

Bronze Medal.

TO ROWE BROS. & CO., LTD.

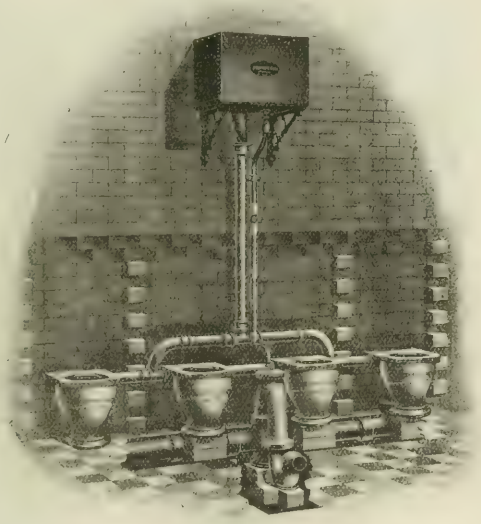
Lead pipes, ranging from $\frac{1}{2}$" to 6" bore, also rectangular, shewing various substances, the heaviest being 1" bore by $1\frac{1}{2}$" thick. Lead soil-pipes and ventilating pipes of every size and substance.

Manufactured by ROWE BROS. & CO., LTD., Canons Marsh, Bristol.

The "Sabden" Isolated Syphonic Closet Range.

Silver Medal.

To J. Duckett & Son, Ltd.



Pedestals made in amber or cane-glazed ware, fitted with polished birch inserted seats; automatic syphonic tank in galvanised iron, painted cast-iron brackets and flush pipes, lead air-extractor pipe, access and stop trap, and ware connecting pipes and syphon complete. Range for 2, 3, 4, 5, or 6 persons.

☞ *Manufactured by* J. Duckett & Son, Ltd., Burnley, Lancs.

Range of Two (Number 34) Urinals.

Bronze Medal.

To G. Howson & Sons, Ltd.

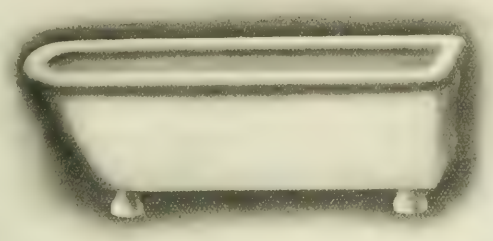
The Urinals are made in pure white leadless-glazed "Westwood" fireclay, the backs, soles, and accessible channels being in one piece, suspended dividing column, ends and floor treads; "drop by drop" automatic cistern, copper supply pipes with gun-metal connections, and spreaders. The joint between the two Urinals is so arranged that a range of two or more stalls can be fitted to completely fill a space between walls without cutting walls or affecting the close joints between parts.

Manufactured by George Howson & Sons, Ltd., Hanley, Staffs.

Porcelain Bath with Broad and Anti-splash Rim.

Bronze Medal.

To G. Howson & Sons, Ltd.



The Bath is made with broad roll and anti-splash rim, pure white leadless-glazed inside and out. The roll formed so that it can be used as a seat, thus doing away with the necessity for wood or other material being applied to the roll.

Size. 6 ft. overall, or any other size to order.

Manufactured by George Howson & Sons, Ltd., Hanley, Staffs.

Cast-iron Drain and Soil-pipe Fittings.

Silver Medal.

To Burn Bros.

Cast-iron Drain Fittings: Inspection chambers, with gas-tight bolted cover. Bends, all sizes from 2 in. to 6 in. in eight stock angles, with or without hand-holes. Branches, all sizes, and all possible diminishing sizes, from 2 in. to 6 in., in eight stock angles. Intercepting gully, silt, and grease traps. Gully inlets, with grated or sealed top, and inlets in any position (large variety in stock). Special Stable Gullies.

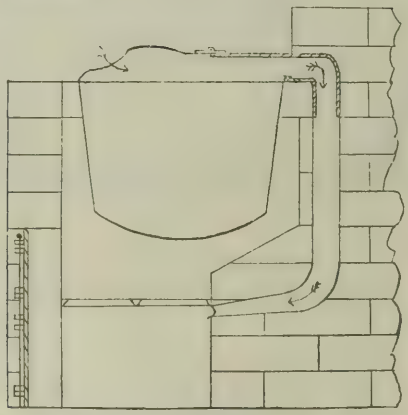
Cast-iron Soil, Waste, and Anti-syphon Pipe Fittings: Bends, 2 in. to 4 in. dia. in eight stock handles, with or without gas-tight handholes. Branches, all sizes, and all possible diminishing sizes from 2 in. to 6 in., in eight stock angles, all with or without hand-holes, right or left hand or on back. Pass-over pipes, traps, etc.

Manufactured by Burn Bros., 3, Blackfriars Road, S.E.

Set-pot Steam Destroyer.

Bronze Medal.

To Henry Thompson.



This Stove is to prevent steam arising in houses, wash kitchens when boiling clothes, or being used for culinary purposes rendering lard and the like. The front is closed by two close-fitting doors to prevent ingress of air to the fire from below. The draught for the fire enters at the lid, where it mixes with the steam, then passes down the conduit, and enters the fire from the ashes place, producing a much greater heat, yet burning less coal.

Sizes. 8 10 12 14 16 18 20 25 gallons.

Prices. 35/- 37 6 40 - 43/6 47.6 53/- 60/- 70/- These prices do not include Pans. Carriage paid on two or more, and a reasonable discount allowed to the Trade.

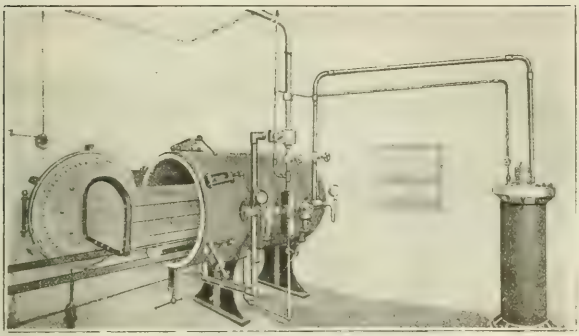
In Parts.—Patented apparatus only, at above prices.

Manufactured by Henry Thompson, 1, Stainton Road, Sheffield.

"Lyon" Type Steam Disinfector.

Silver Medal.

To Goddard, Massey, & Warner, Ltd.



The Steam Disinfector consists of a chamber, made either oval or round in shape, constructed with steel boiler plates, and surrounded by a casing of steel plates; the two steel casings are strongly rivetted by hydraulic pressure to solid end frames, and supported by special screw stays, and strengthened by T-iron ribs. The ends of the machine are closed by means of steam-tight doors constructed of steel plates, with thickness frame, to form a space for steam inside, each door having hinged joints and tightening screws connected to the steam chamber, and drain cocks attached. The machine is fitted with an exhaust and vacuum arrangement, to provide for quickly exhausting steam from the machine, and putting a current of hot air through.

In various sizes.

Manufactured by Goddard, Massey, & Warner, Ltd., Nottingham.

Equifex Saturated Steam Disinfector, with Super-heated Dryer.

Silver Medal.

To J. Defries & Sons, Ltd., 147, Houndsditch, E.C.

*

Steam-jacketed Cooking Pan.

Bronze Medal.

To Summerscales, Ltd.

These Pans are self-contained, and are fitted with steam and cold water valves, steam being connected with the jacket, and water connected with the inner pan. A large gun-metal draw-off cock, with cleaning screw and lignum-vitæ handle, is provided for emptying the pan. The lid has a balance weight attached, so that it may be retained open or closed, as desired. The pans are lagged with blued sheet steel, and can be supplied with both pans of cast-iron, or with the inner pan of copper, tinned inside if desired. A connection is provided for attaching vapour pipe to carry away steam and fumes when cooking.

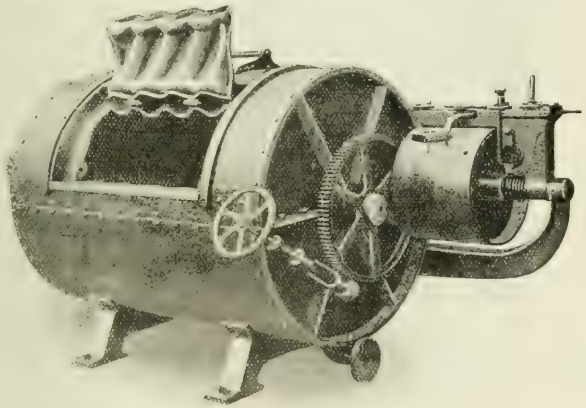
Made in sizes from 15 to 100 gallons.

Manufactured by Summerscales, Ltd., Keighley, Yorks.

Helical Washing Machine.

Bronze Medal.

To Goddard, Massey, & Warner, Ltd.



The outer shell of the machine is made of boiler plates bolted to cast-iron ends, made in halves, to facilitate removal of the inner cage, the axle of which revolves in long cast-iron swivelling bearings adjustable in any direction, and provided with means for excluding any escape of steam or water. The cage is constructed upon an entirely new principle. It is made throughout of metal, the cylinder being of hard rolled brass, having deep spiral corrugations from end to end, forming beaters, which also transmit an endwise movement to the articles under the process of washing, in addition to the rise and fall in the washing substance. The driving gear reverses the cage every three revolutions. A special hand turning motion is provided to the inner cage by worm and hand wheel, with locking device for loading and unloading the goods. The shell is fitted with hot and cold water inlet, and large outlet cocks and water gauge.

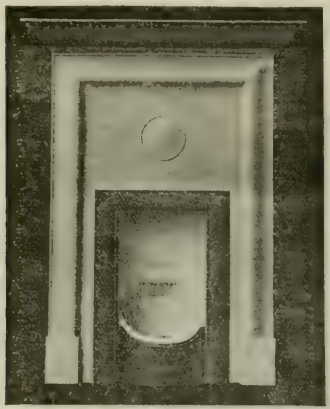
In various sizes.

Manufactured by Goddard, Massey, & Warner, Nottingham.

The "Burkone" Fire.

Bronze Medal.

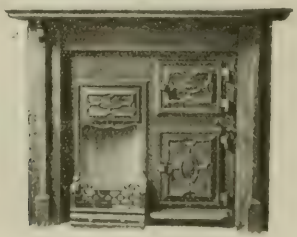
To the Standard Range and Foundry Co., Ltd.



The "Burkone" Fire is shaped in the form of a basin, with an iron cone grate at the bottom, the shape of the fire causing the fuel to fall continually towards the cone. The fire is cleaned by lifting the cone, the ashes dropping into the iron tray beneath.

The Combination Heating and Cooking Range.

Bronze Medal.



Self-contained flues, heavy ovens, heavy fall bars for kettles and pots. The fall bar is useful for burning logs; bottom heat. The range can be fitted with high-pressure boiler for bath supply if required, at slightly extra cost.

Size.—Made in one size only, 38 ins. × 38 ins. Oven and hot closet measure 14 ins. × 14 ins. inside.

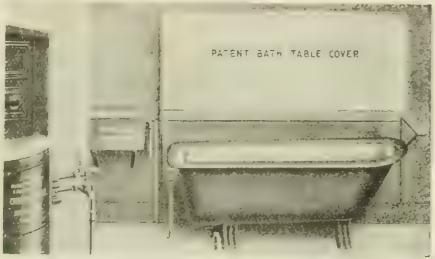
Price, complete, £3 16s. Oak Mantelpiece, extra, £2 10s. These prices are subject to trade discount.

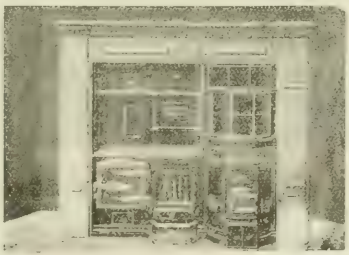
Manufactured by The Standard Range & Foundry Co., Ltd., Watford.

The Combination Range, Copper, and Bath.

Silver Medal.

To Cornes & Haighton.





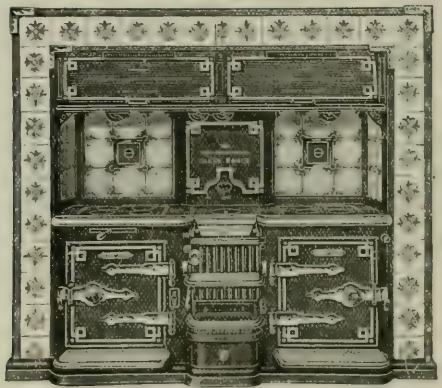
The Model Cottager Combination is fitted between the kitchen and scullery or bathroom, and economises space, coal, and labour. The copper is heated by the kitchen fire, and gives a supply of hot water. The heat from the kitchen fire passes round the radiating front and back of the copper, and the boiler is accessible from the scullery or bathroom. Hot water, which is on the low-pressure system, can be drawn in the scullery for bathing or other purposes; and one of the salient features of the apparatus is that there is no risk of explosion, inasmuch as there is nothing sealed, and the whole fitting can be manipulated with the greatest ease and safety.

Manufactured by The Patentees, Cornes & Haighton, 244, High Holborn, W.C.

"Premier" Eagle Range.

Bronze Medal.

To the Eagle Range & Gas Stove Co., Ltd.



The Premier Gold Medal Eagle Range, with the following special advantages: All flues enclosed (including boiler flue); hinged front bars; boiler easily removed from front; improved reversing damper for heating top or bottom of oven; bottom grate easily worked with one hand; patent draught regulator; increased depth of hot plate; perfect oven ventilation; smoke-consuming fire cheeks; perfect front roasting; movable toast plate; wearing parts interchangeable; indicating oven dampers; separate boiler damper, etc.

Sizes.—4 ft. to 6 ft.

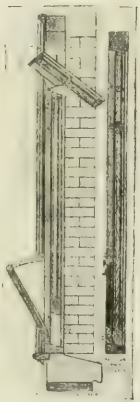
Prices. £15 15s. to £30.

Manufactured by The Eagle Range and Gas Stove Co., Ltd., Catherine Street, Aston, Birmingham.

Automatically-opening Sash Ventilator.

Bronze Medal.

To C.C. Ventilator Co.



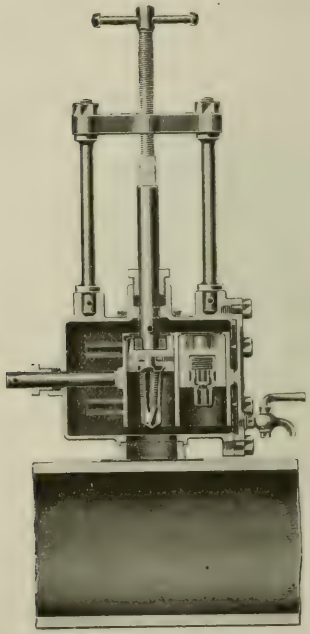
The window comprises a single sliding sash, the bottom portion of which is hung with weights, and the top portion is pivotted to form a fanlight; both are so connected that the act of raising or lowering the bottom portion automatically opens or closes the fanlight. When the sash is raised, the top rail is some inches above the lowest part of the fanlight, thus preventing rain drifting in, and also acting as a mid-feather and preventing the air travelling downwards.

The side beads of sash frame are fitted with slotted plates and pins, and can be readily taken off and replaced when required; by this means the lower sash may be swung into the room for cleaning.

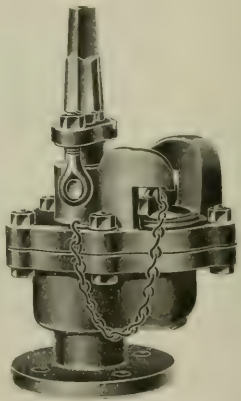
Further information and prices may be obtained on application to the Patentees and Manufacturers, The C.C. Ventilator Co., 85, Duke Street, Liverpool.

Screw-down Hydrant, adapted to Ball-hydrant connection.
Bronze Medal.

Boyd's Water-main Drilling-and-tapping Apparatus.
Silver Medal.



DRILLING AND TAPPING APPARATUS.



SCREW-DOWN HYDRANT.

The Drilling and Tapping Apparatus is attached to the main with a suitable saddle, using thin sheet of rubber to make the joint. After drilling and tapping, the drill is withdrawn and the spindle detached. The pressure of water then causes the carriage to slide, bringing the ferrule over the hole drilled. The spindle is again used to screw it home.

The Screw-down Hydrant has been introduced to replace the ball hydrant: the type illustrated overcomes the risk of pollution, and has been so designed that the same stand-pipes may still be used as were formerly in use with ball hydrants.

PRICES.	*Diameter of Inlet*	2½″	3″	4″
Complete, with chained cast-iron cap to protect outlet		27s.	32s.	48s.
Do. but without frost plug		26s.	31s.	47s.

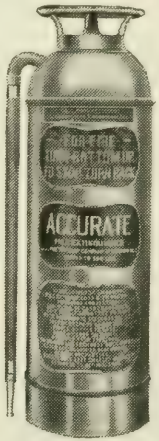
All carefully tested to 600-ft. head of water.

Manufactured by J. BLAKEBOROUGH & SONS, Brighouse, Yorks.

The "Accurate" Fire Extinguisher.

Bronze Medal.

To The Underwriters' Fire Appliances, Ltd.



The "Accurate" is a chemical fire appliance from the United States. The extinguishers have a patent automatic self-feeding stopper inserted in the neck of the bottle which contains the acid. This stopper causes the acid to distribute so gradually among the bicarbonate of soda solution that all the acid is taken up and assimilated with the solution, and therefore turned into carbonic acid gas, when of course its ill-effects become neutralised. The machine has merely to be turned upside down to cause it to throw out a strong steady stream of fire-quenching liquid from 40 to 50 feet in length. The makers also supply chemical extinguishers and engines of all sizes, from one gallon "automobile" for motor cars to large 40 and 60-gallon engines on wheels for large institutions, and pair-horse engines for fire brigades.

Prices on application.

Manufactured by The Underwriters' Fire Appliances, Ltd., 30, Fleet Street, E.C.

Tar-spraying Machine.

Bronze Medal.

THE TAROADS SYNDICATE, LTD.

Taroads Patented 200-Gallon Horse-drawn Tar-spraying Machine. This machine, which is of metal construction throughout, is fitted with a special safety heating apparatus. It sprays the tar at the rate of from 6 to 14 square yards per gallon according to requirements, and at a width of from 1 ft. 6 ins. to 5 ft. 6 ins. It is so designed that one horse can draw the machine when working, and that the whole of the operations can be controlled by an ordinary roadman. These machines are suitable for ordinary road-surface treatment, or for the construction of "in situ" tar-macadam roads.

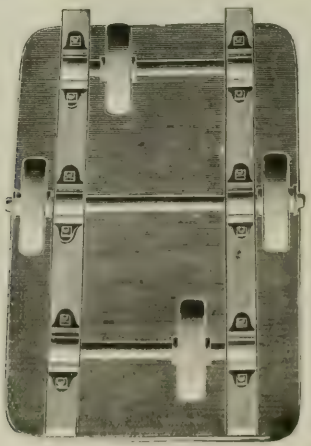
PRICE. £120 nett.

Manufactured by THE TAROADS SYNDICATE, 9, Victoria Street, E.C.

Sliding-wheel Trollies and Trucks.

Bronze Medal.

TO H. C. SLINGSBY.



This Truck runs both ways, runs straight, and spins like a top.

Manufactured by H. C. SLINGSBY, 142, 144, and 146, Old Street, London, E.C.

Extension Ladder.

Bronze Medal.

To H. C. Slingsby.

"Steelback" Ladders have a channel steel liner fitted on the entire length, put on at a high tension, which forms a camber on the ladder and gives strength with lightness. The automatic locking arrangement is simple, having no spring to get out of order, being manipulated by the rope. The extension pieces are same size as lower portion of the ladder, and elevate from the back.

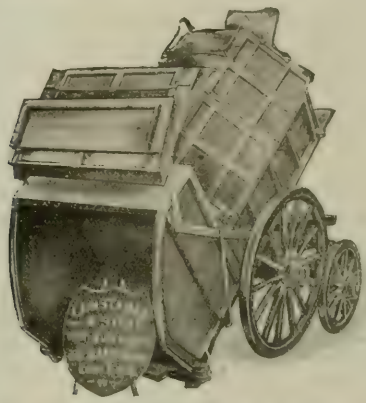
Size.—12 ft. closed, extends to 22 ft.: weight, 37 lbs.

Manufactured by H. C. Slingsby, 142, 144, and 146, Old Street, E.C.

The "Perfect" Refuse-collecting Van.

Silver Medal.

To Constable & Son.



The above van is covered by pairs of lids, and upon opening any pair a wind-guard is formed by the lids being held in an upright position by a patent fastener. To tip the van a bolt is drawn, the horse then backs, and the body of the van moves over two friction rollers, and, passing the point of equilibrum, tips automatically. At the moment the van tips the back unfastens (also automatically) without the aid of chains or levers.

Size to suit districts. Price according to size. In parts if desired.

Manufactured by The Horsfall Destructor Co., Ltd., Atlas Works, Pershore.

Hospital Filter, with Thermometer, for providing Sterile Water.

Silver Medal.

To Slack & Brownlow.

Hospital Filter with thermometer attached, so arranged that hot or cold sterile water is provided quickly. This is a great boon to hospitals, and will be found of immense value in providing suitable germ-free water for surgical operations.

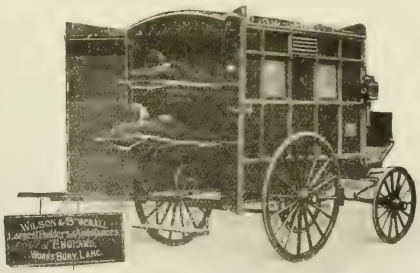
Sizes and prices on application.

Manufactured by Slack & Brownlow, Gorton, Manchester.

Accident Ambulance.

Silver Medal.

To Wilson & Stockall, Ltd.



A special feature is the provision for ingress and egress, the ambulance being hung so low on a cranked axle, that an injured person can be placed in position with ease. This Ambulance contains two stretchers, (A) the upper one, runs in on a folding rabbetted frame; it is partly supported from the roof, and also by side quadrants and stays, which, when stretcher is required, are lowered to the *same level as the bottom stretcher*, when patient is placed on, and then raised to its position and effectively secured. (B) The lower stretcher is furnished with 14-in. rubber tyred wheels, and can be used to run the patient along the floor; the wheels, spring, and axle are detachable, then the stretcher can be carried up and down stairs: this stretcher is run into the ambulance body on grooves on the bottom after being placed upon a portable tramway, which is fitted to the back of the body; this neatly folds up, is carried with the stretcher, and is always ready. The stretcher is also fitted with an arrangement for raising the patient when the ambulance is descending a steep incline. Both stretchers are covered with stout tanned canvas, and two pillows for same are supplied: there are also two outside and one inside lamps, powerful brake, shafts, embossed side windows.

Prices on application.

Manufactured by Wilson & Stockall, "Ambulance Specialists," Bury, Lancs.

Pure Welsh Health-Flannel.

Bronze Medal.

To The Welsh Industries Association.

This flannel is made of specially selected fine Welsh wool. Its nature and the peculiar twist imparted to it in the process of spinning give it the characteristic of non-shrinkability, for which so many real Welsh fabrics are famous the whole world over.

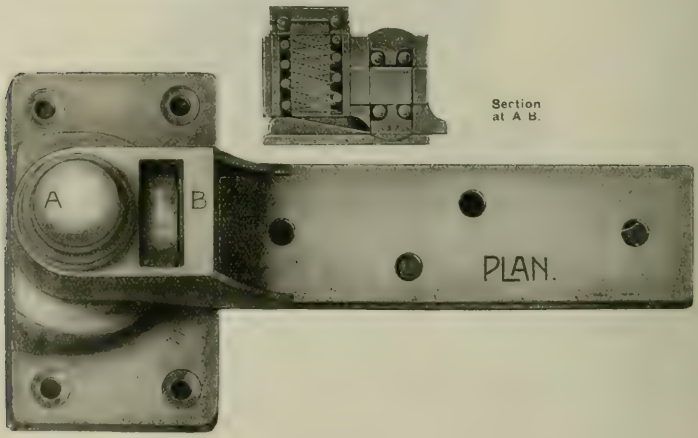
Price from 1s. 3d. per yard.

Manufactured by The Welsh Industries Association, Glamorgan Branch, 131, Queen Street, Cardiff.

Ball-bearing Door Pivot.

Bronze Medal.

To the "England" Works.



The "England" Patent Ball-bearing automatic door pivot for double-action doors, can be opened by the slightest pressure with the hand or elbow, is never held in check, and does not impede progress in case of panic or fire. The "England" Pivot allows the door to fit the threshold draught proof, and will rise clear of any floor covering on either side of doors; this method can be adopted to iron thresholds, and does not necessitate the cutting away of floors. It can be fixed to any existing double-action door without any alteration of top centres.

Only one size for any weight or size of door.

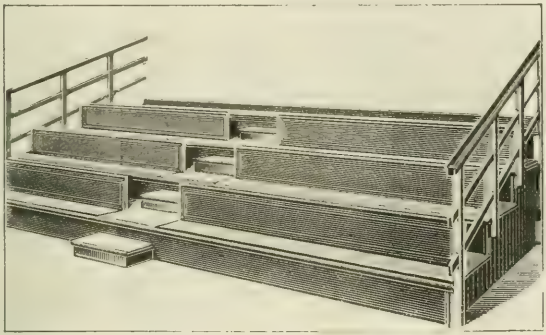
Price.—From 25s. per set.

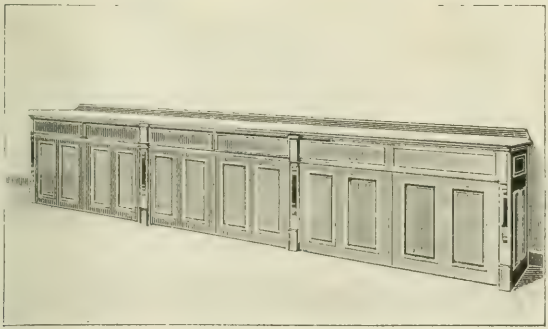
Manufactured by The "England" Works, North Street, Leeds.

Portable Platform and Galleries.

Bronze Medal.

THE BENNET FURNISHING CO., LTD. (Warwick Patent, No. 21,495).





A Platform or Gallery adapted to School-room, Lecture Hall, or Concert Hall use, and capable of being quickly folded away into a small space, encased in panelling, having the appearance of a cupboard standing against wall. May be stepped to provide seats for children or for staging chairs to accommodate adults. May also take the form of a level platform or stage. Is absolutely rigid, and may be secured to the wall or be made portable on castors. Can be made to any reasonable dimensions, and the operation of folding away or arranging for use can be undertaken single-handed, and takes but 15–20 minutes.

Sizes to suit requirements.

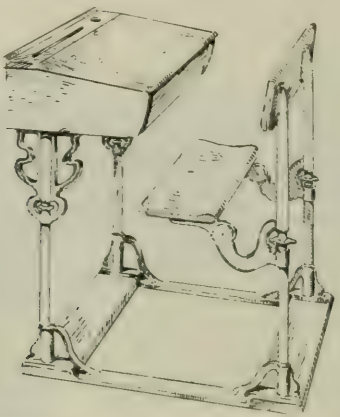
PRICES. From 3s. to 4s. 6d. per foot super.

Manufactured by THE BENNET FURNISHING CO., LTD., 47, Glengall Road, S.E.

Adjustable School Desk.

Bronze Medal.

The Bennet Furnishing Co., Ltd.



The "Castle Desmond" Patent Adjustable Desk. To raise the desk or seat part is simply a matter of lifting. For the fixing at any position, variable in fractions of an inch, is automatic. The lifting can be done by the knees of the scholar sitting at the desk. To lower, slight pressure is exerted on the steel catch. The working parts are steel forgings. These adjustable standards can be applied to almost any style of single desk to suit special requirements.

Sizes and Prices. As a locker desk (length 24 ins., floor space 32 ins.): pitch pine, 35s.; orham, 36s.; oak, 37s. 6d. As a box desk (length 24 ins., floor space 30 ins.): pitch pine, 29s.; orham, 30s.; oak, 31s. Locks, 2s. 6d. each extra.

Manufactured by The Bennet Furnishing Co., Ltd., 47, Glengall Road, S.E.

Educational Gymnastic Outfits.

Silver Medal.

To Spencer, Heath, & George, Ltd.

Portable and Adjustable Educational Gymnastic Apparatus for School Halls: Wall bars, Swedish ladders, double beams, vaulting horse, forms, climbing ropes, mats; physical measurement apparatus; scientific development machines.

Manufactured by Spencer, Heath, & George, Ltd., 48, Goswell Road, London, E.C.

"Autan" Disinfectant.

Bronze Medal.

The Bayer Co., Ltd.

The apparatus necessary consists of a tin pail, bucket, or some such vessel, into which the Autan powder is put, and a stick for stirring the powder and water to a paste. The tin in which the Autan is packed serves as a measure for the water. In a few seconds the paste effervesces violently on account of the chemical action which takes place, and great volumes of formaldehyde and steam are given off.

Sizes.	100	175	350	700	1,400	2,100	2,800	4,000 cubic feet.
Prices.	6d.	9d.	1s. 3d.	2s. 5d.	4s. 3d.	6s.	8s.	10s. per tin.

Manufactured by The Bayer Co., Ltd., 19, St. Dunstan's Hill, London.

Danysz Virus of recent preparation.

Bronze Medal.

To Danysz Virus, Ltd.

Danysz Virus is a bacteriological preparation for the extermination of rats and mice; it was discovered (in 1892) by Dr. Danysz, the present Director of the Laboratory of Agricultural Microbiology at the Pasteur Institute, Paris. Danysz Virus is harmless to human beings, domestic and other animals, birds, etc., and has the great advantage of affecting the vermin in such a way as to cause them to leave their usual haunts and make for the open. In many instances vermin are found dead a long way from where the bait has been laid.

Danysz Virus is supplied in glass tubes, with full directions round each tube, at the price of 2s. a single tube, 5s. for three tubes, 18s. per dozen. Special estimates will be given for larger applications.

Manufactured by Danysz Virus, Ltd., 52, Leadenhall St., London, E.C.

Washed and Sterilized Flock.

Bronze Medal.

To Thomas Richard Freeman.

All classes of washed and sterilised wools and millpuffs and curled hair for mattresses, overlays, and shake-up beds, and for upholstering chairs, couches, etc.

Manufactured by T. R. Freeman, Monkton Combe Mills, near Bath; also Freshford Mills, near Bath, and Avoncliff Mills, Bradford-on-Avon.

"Dustolio."

Bronze Medal.

To The Sanitary Floor Co.

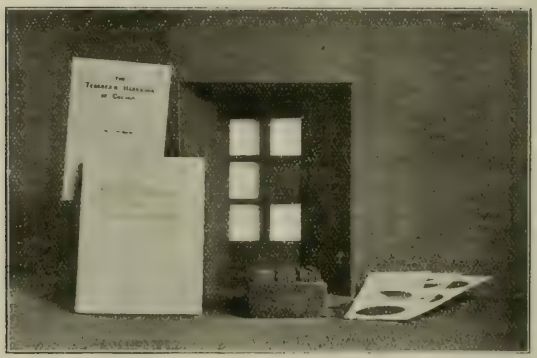
A liquid for applying to ordinary wood floors, linoleum, cork matting, etc., to prevent the formation of dust.

Manufactured by The Sanitary Floor Co., 177, Temple Chambers, London, E.C.

The Colour Educator.

Silver Medal.

JOSEPH W. LOVIBOND, ESQ.



An apparatus for teaching colour and colour names in schools, and testing colour-blindness in the students. It consists of standard spectrum colours in glass; frame to hold standards; white plate for dealing with opaque colours; diagrams; and small handbook on colour for teachers, with instructions as to the method of use of the Colour Educator.

All shutting up in a compact case, size 9″ × 11″.

Price £1 10s.

Manufactured by THE TINTOMETER, LTD., The Colour Laboratory, Salisbury.

Standard Books on Sanitary Science.

Bronze Medal.

TO THE SANITARY PUBLISHING CO., LTD.

Standard Books on every branch of sanitary science for municipal and sanitary engineers, surveyors, food inspectors, and public health officials generally; also Students' Text-books and Local Government Handbooks.

Published and sold by THE SANITARY PUBLISHING CO., LTD., 5, Fetter Lane, E.C.

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